Nokia Customer Care

Service Manual

RM-704 (Nokia C2-00)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Original issue	05/2011	Jeff Zhao	

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IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user’s guide for detailed safety instructions. Do not connect incompatible products.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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- Title of the Document + Issue Number/Date of publication
- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

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Nokia C2-00 Service Manual Structure

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1 — General Information

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Product selection

RM-704 (Nokia C2–00) is a GSM Quad-band phone, supporting EGSM 900/1800 bands.

Figure 1 RM-704 (Nokia C2-00) product picture

Phone features

Hardware features

- One internal SIM slot under battery
- One external SIM slot, hot-swap enabled
- HW16, Dual-band variants: EGSM 900/1800 & GSM900/1800 – Edge down link only
- Combo 32 MB Flash, 16 MB SDRAM
- Codecs supported: FR, EFR, HR, AMR
- SIM support: 3volt, 1.8volt
- 128x160 TFT display (ACF)
- microSD card slot, hot-swap supported
- VGA Camera
- Long battery life time (BL-5C; 1020mAh)
- Nokia AV connector
- Stereo FM Radio & Radio recording, RDS

- Bluetooth
- BTHCost4.0
- 3in1 speaker
- Clapton microphone
- Speaker loudness: 103db
- 3.5mm audio jack
- Micro USB

SW features (S40 SPR10.4)

- Smart Dual SIM, swap external SIM without rebooting
- UI: D5, Entry S40 UI, connect UI, 3soft keys, 5way Navi™ key
- Full MP3 player
- Bluetooth connectivity
- Stereo FM radio and recording
- MP3 ringing tones
- Java MIDP 2.1
- OMA DRM 2.0
- WAP 2.0
- MMS 1.3
- SyncML 1.2
- Native Email Client
- Nokia Xpress Audio messaging
- Theme 3.0
- Organizer with local calendar
- Expense manager
- Advanced calculator
- Converter II
- FOTA/NSU

Applications

- Nokia Cherry 2.5
- Ovi Life Tool 1.7
- Nokia Messaging service 2.0

Accessories

In-box:

- Phone: Nokia C2–00
- Battery: BL-5C
- Chargers: AC-3 (China use AC-8C and CA-100C)
- Headset: WH-102

For out-box accessories, please refer to enhancement list document.

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BL-5C 1020 mAh Li Lion battery pack	108 x 45 x 14.65	74.1	67.9

Battery endurance

Battery	Talk time		Stand-by time	
BL-5C with 1020 mAh Li Lion standard battery	Best Talk Time	ECTEL Talk Time	Best Stand-by Time	ECTEL Stand-by Time
	11.5 hours	5.7 hours	570 hours	460 hours

Note: Variation in operation time will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active and reduced by 5% if enhanced full rate is active.

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2 — Service Tools and Service Concepts

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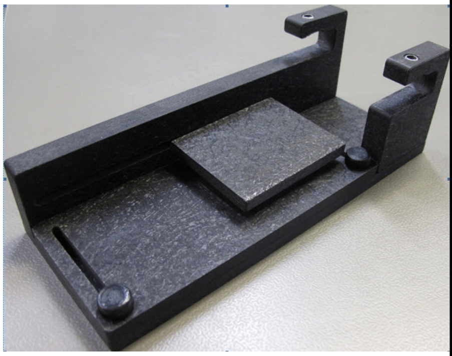
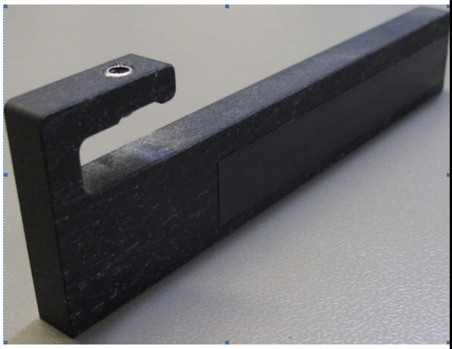
Service tools

Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-704. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	SS-255	Protection plate	
	SS-255 is designed as protection plate working with SS-256 for OKI soldering machine.		
	SS-256	Blowing nozzle	
	SS-256 is a blowing nozzle which can be used with protection plates for different soldering machines.		
	SS-257	Protection plate	
	SS-257 is designed as protection plate working with SS-256 for Martin soldering machine.		

General tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-704. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CU-4	CU-4	Control unit	
	CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.		

The unit has the following features:

- Software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- Software controlled BSI values
- Regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.

2 Connect CU-4 to your PC with a USB cable.

3 Connect supply voltage (12 V)

4 Connect an FBUS cable (if necessary).

5 Start service software.

Note: Service software enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a service software restart.

FPS-21

FPS-21	Flash prommer	

FPS-21 sales package:

- FPS-21 prommer
- AC-35 power supply
- CA-31D USB cable

FPS-21 interfaces:

Front

- Service cable connector

  Provides Flashbus, USB and VBAT connections to a mobile device.
- SmartCard socket

  A SmartCard is needed to allow DCT-4 generation mobile device programming.

Rear

- DC power input

  For connecting the external power supply (AC-35).
- Two USB A type ports (USB1/USB3)

  Can be used, for example, for connecting external storage memory devices or mobile devices
- One USB B type device connector (USB2)

  For connecting a PC.
- Phone connector

  Service cable connection for connecting Flashbus/FLA.
- Ethernet RJ45 type socket (LAN)

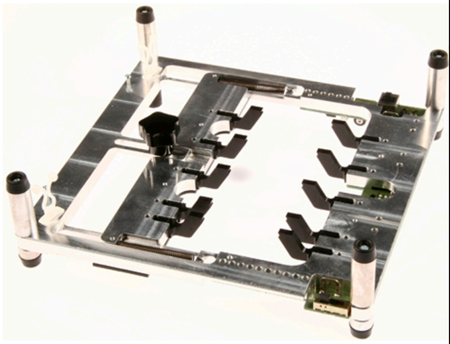
  For connecting the FPS-21 to LAN.

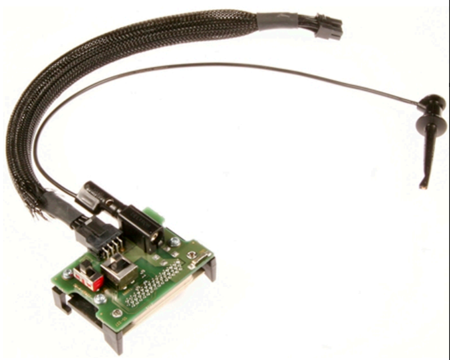
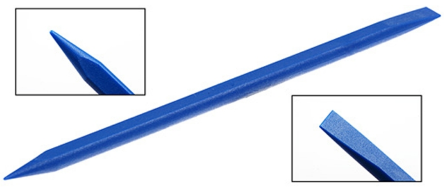
Inside

- Four SD card memory slots

  For internal storage memory.

  Note: In order to access the SD memory card slots inside FPS-21, the prommer needs to be opened by removing the front panel, rear panel and heatsink from the prommer body.

	MJ-300	Module jig	
	Module jig MJ-300 can be used for flashing via USB and RF, battery and system testing. The main functions are: • Powering with external power • CU-4 interface adapter to phone (requires SS-227) • WLAN/BT/GPS RF-interfaces with probes • GSM/WCDMA RF-interfaces with probes • BSI mode selector (Tabby and Lynx interface, selected with battery cable) • VBATT interface (Tabby and Lynx interface, selected with battery cable) • CA-128RS cable is used together with this jig for RF testing		
	PK-1	Software protection key	
	PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle. PK-1 is meant for use with a PC that does not have a series interface. To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.		
	RJ-230	Soldering jig	
	RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.		
	SRT-6	Opening tool	
	SRT-6 is used to open phone covers. **Note:** The SRT-6 is included in the Nokia Standard Toolkit.		

	SS-227	Interface for CU-4 control unit	
	SS-227 is designed for regional Central Services to be able to use CU-4 with MJ-300 module jig. With SS-227, CU-4 can be used for battery testing. The main functions of SS-227 are: • CU-4 interface adapter to MJ-300 • BSI mode selector (Lynx and Tabby mode selection) • VBATT interface All functions are performed in the CU-4. Calibration voltages and currents e.g. are protected and monitored by the CU-4 interface software (protection for over-current, overvoltage and reverse voltage).		
	SS-93	Opening tool	
	SS-93 is used for opening JAE connectors. **Note:** The SS-93 is included in Nokia Standard Toolkit.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-21 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-704. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	CA-101	Micro USB cable	
	The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.		

	CA-128RS	RF tuning cable	
	Product-specific adapter cable for RF tuning.		
	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-21 to a PC. It is included in the FPS-21 sales package.		
	CA-89DS	Cable	
	Provides VBAT and Flashbus connections to mobile device programming adapters.		
	CA-99PS	Adapter	
	CA-99PS adapter, 3.5 jack to 5.5 plug.		

	PCS-1	Power cable	
	The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.		
	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WCDMA/WLAN: 0.6+-0.1dB		

Service concepts

POS (Point of Sale) flash concept

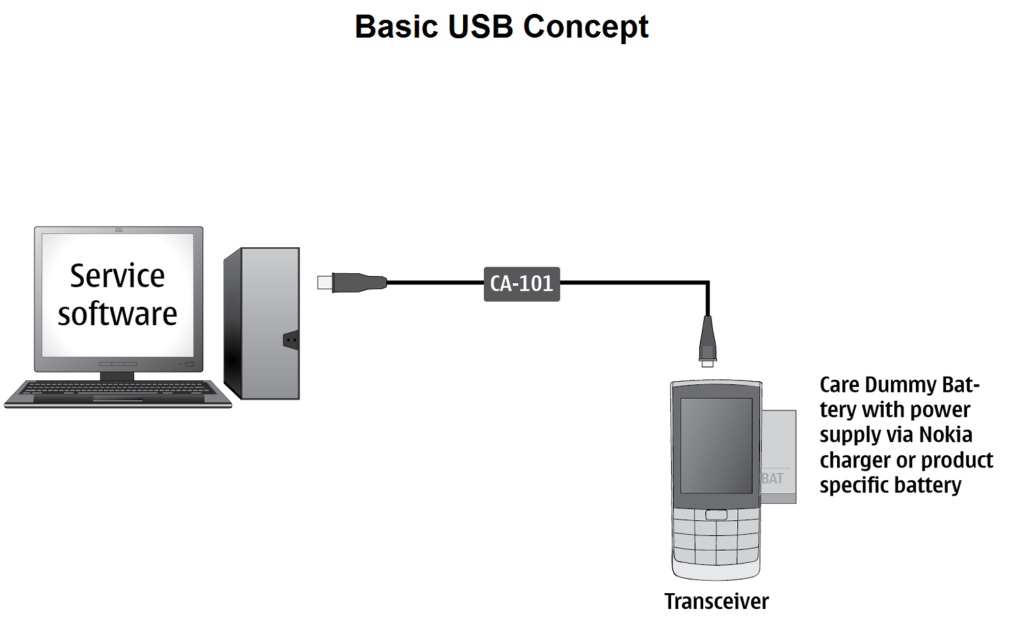


Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-5C	Battery
Other tools	
	PC with Care Suite
Cables	
CA-101	Micro USB cable

Flashing, certificate restore and product code change

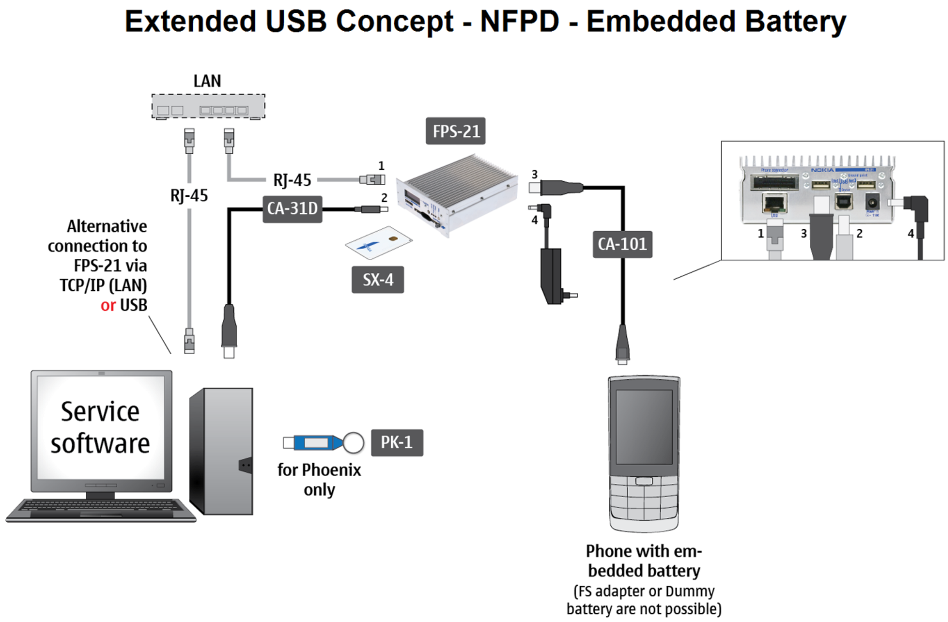


Figure 3 Flashing, certificate restore and product code change

Type	Description
Product specific devices	
BL–5C	Battery
Other devices	
FPS-21	Flash prommer box
AC-35	Power supply
PK-1	SW security device
SX-4	Smart card
	PC with service software (Phoenix)
Cables	
CA-101	Micro USB cable
	USB cable

Flashing, certificate restore, product code change and EM calibration

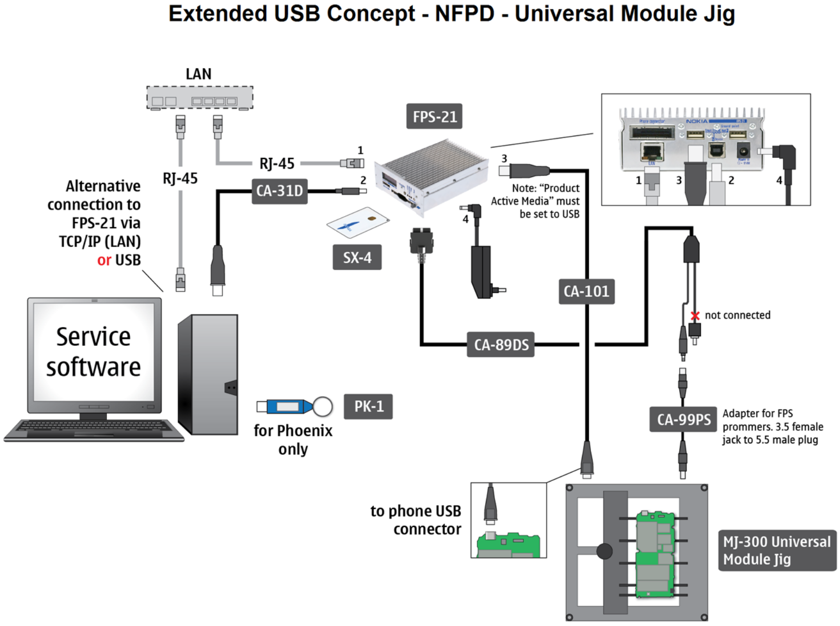


Figure 4 Flashing, certificate restore, product code change and EM calibration

Type	Description
Product specific tools	
MJ-300	Module jig
Other tools	
CU-4	Control unit
FPS-21	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with service software (Phoenix)
Cables	
CA-101	Micro USB cable
CA-89DS	Service cable
CA-99PS	Adapter
PCS-1	Power cable
	USB cable

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BB and RF tuning

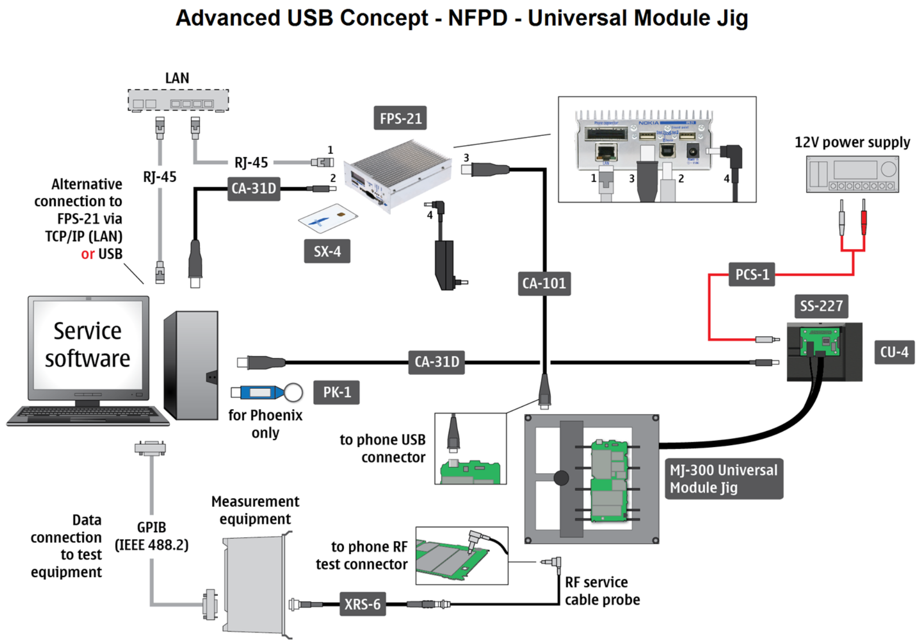

Figure 5 BB and RF tuning

Type	Description
Phone specific devices	
MJ–300	Module jig
Other devices	
CU-4	Control unit
SS-227	CU-4 interface part
FPS-21	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with service software (Care Suite)
	Measurement equipment
Cables	
CA-101	Micro USB cable
PCS-1	DC power cable
XRS-6	RF cable
	USB cable
	GPIB control cable
CA-128RS	Product specific RF adapter cable

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3 — BB Troubleshooting and Manual Tuning Guide

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Baseband Troubleshooting

The following sections contains guidelines how to identify and correct basic baseband related faults. Access to normal LAB equipment (power-supply, digital multi-meter and oscilloscope) is a prerequisite for following the guidelines. Due to the small size of the components and test-points, access to a microscope or magnifying glass is recommended.

Introduction to BB Troubleshooting

Initial baseband troubleshooting normally involves the measurements of various power supply voltages and control signals. The location on the most important test-points is indicated in the following figure:

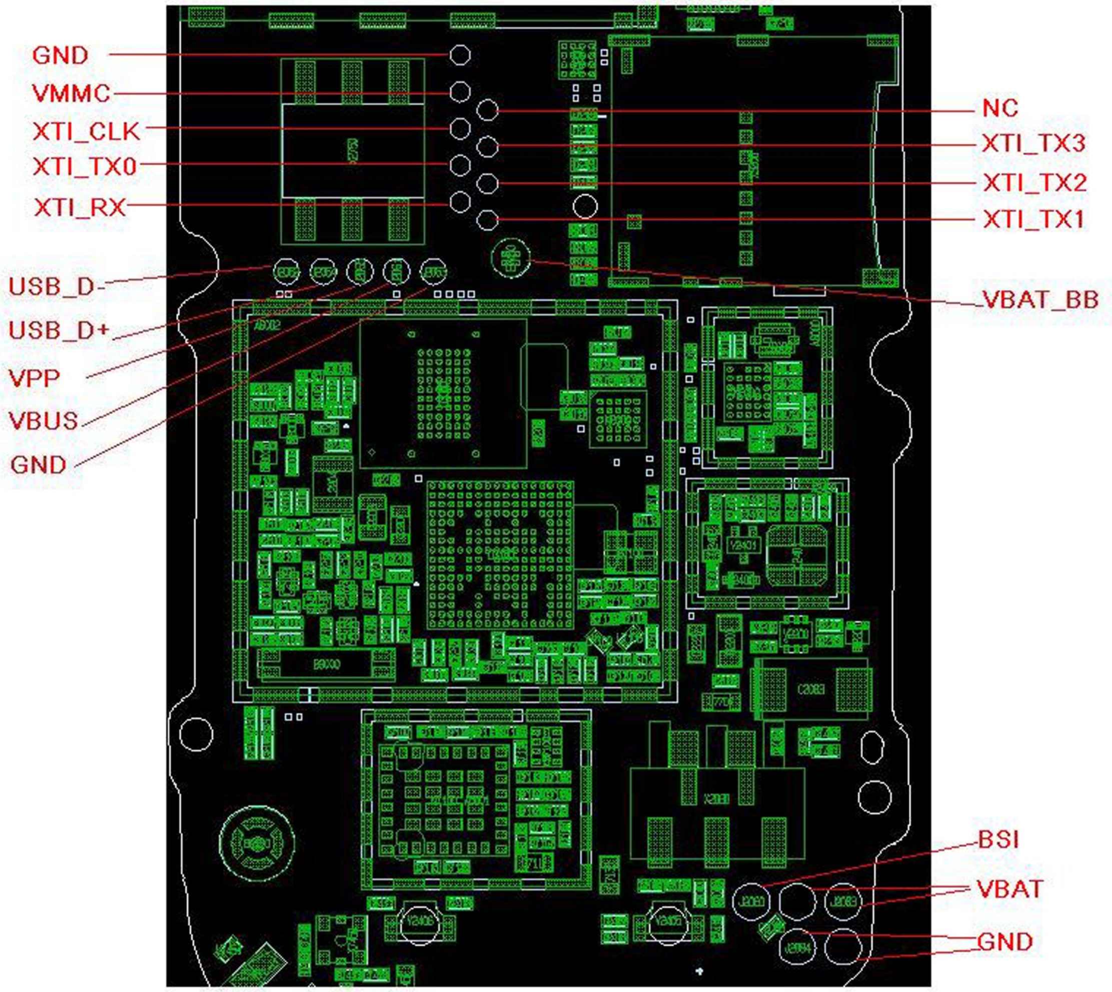


Figure 6 Baseband test point locations

Non re-workable Baseband Components

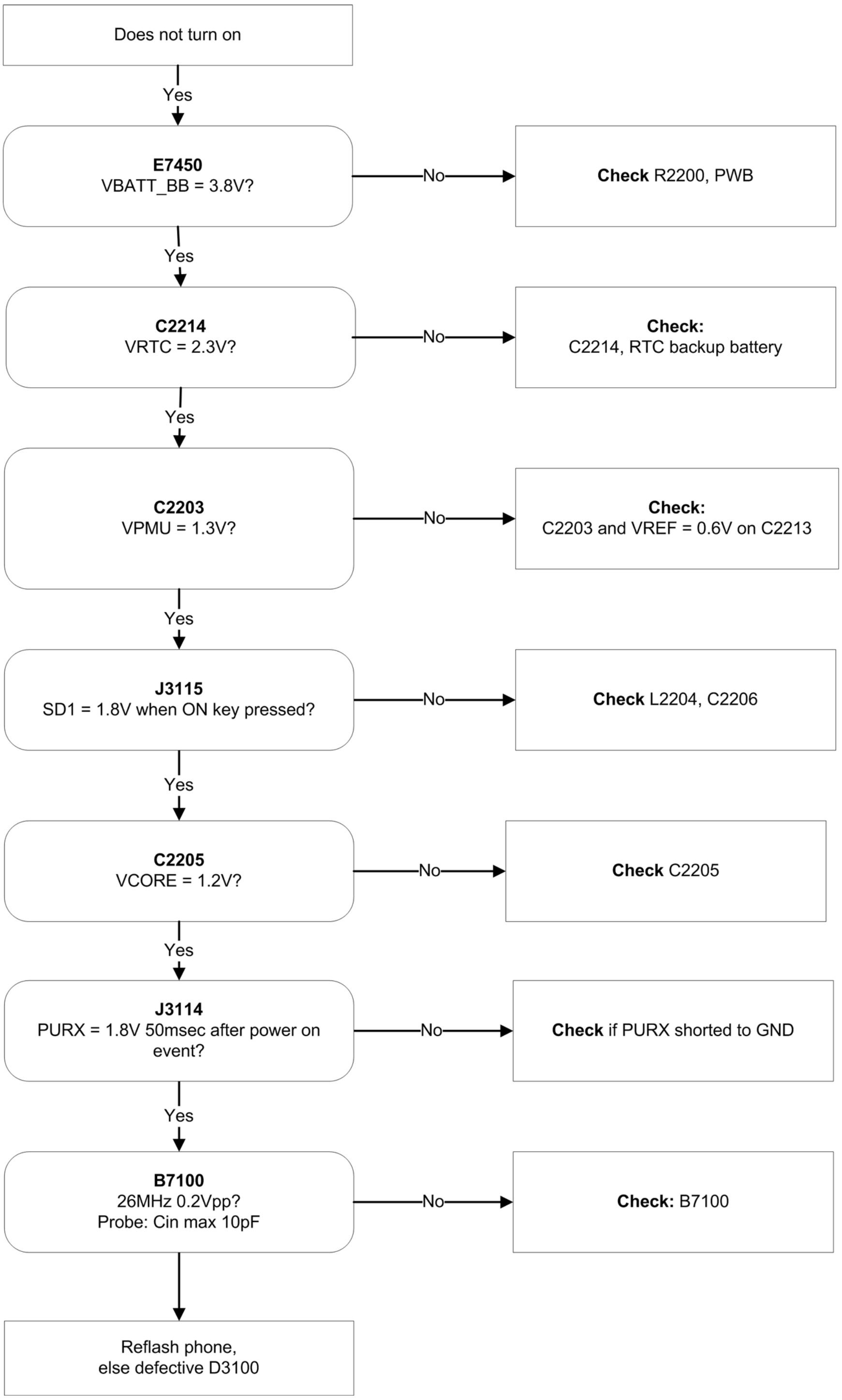
The XGold 213 V2.1S GSM controller IC D3100 is non-reworkable. This means that if failure diagnostics leads to the conclusion of defective D3100, the PWB has to be swapped with a working unit.

Baseband main troubleshooting

The following sections will contain in-depth trouble-shooting guides for various areas of the baseband circuit. It is assumed that a battery simulator containing a valid BSI resistance is used to supply the phone, or a valid battery is used.

Phone does not power on

Troubleshooting flow



Power supply troubleshooting

High current

If the phone draws excessively high current upon power on or insertion of battery, it means that VBAT or a LDO output is shorted.

Listing 1: High current when battery is inserted, I>500mA;

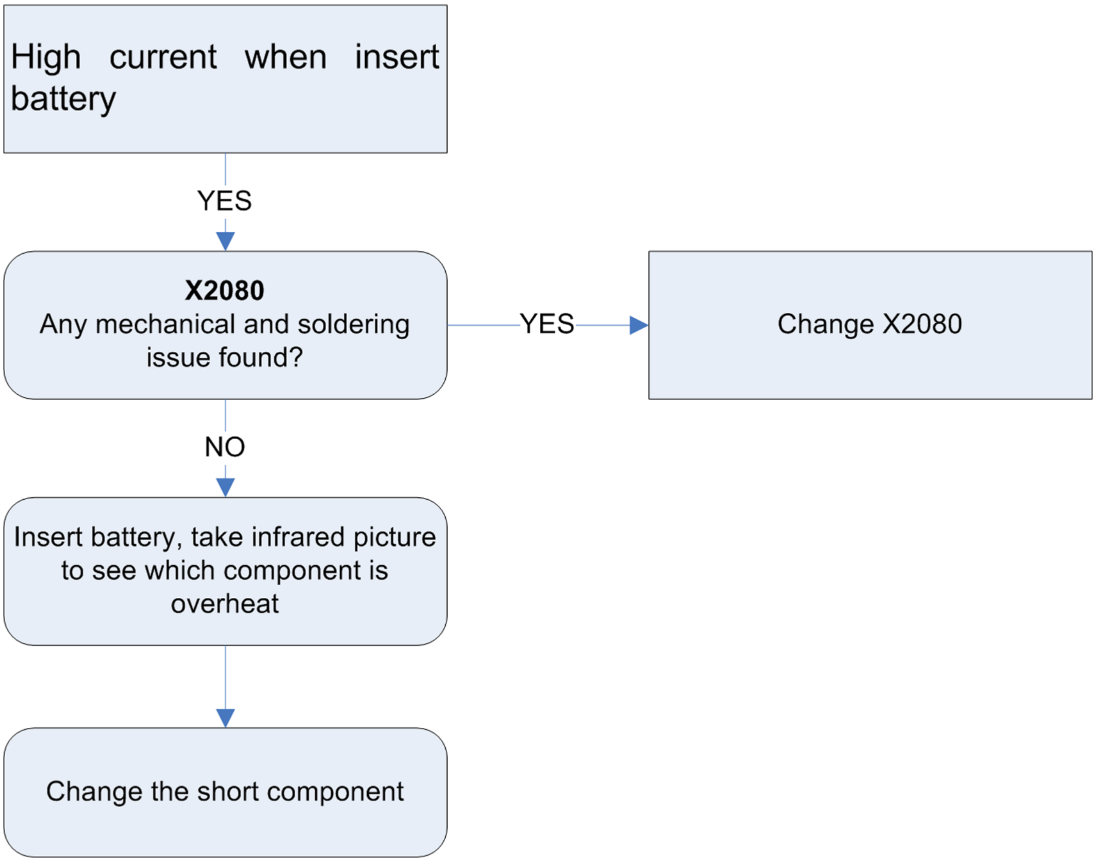


Figure 8 High current when battery inserted

Refer to the following picture:

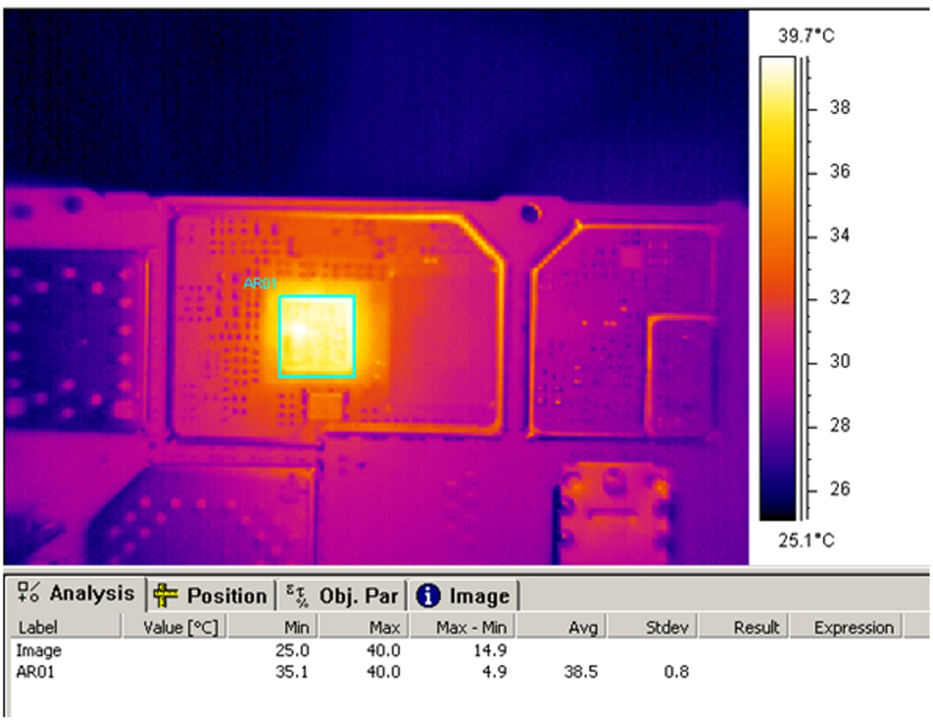


Figure 9 IR picture showing component overheat

Listing 2: High current after pressing power-on key, 100mA<I<500mA.

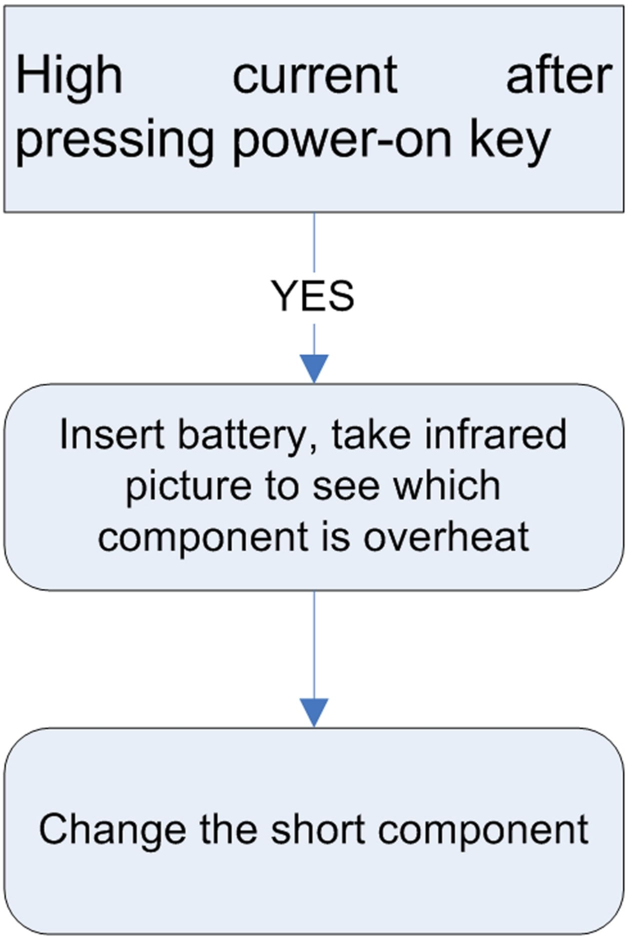


Figure 11 High current after pressing power-on key

No current when pressing power on key

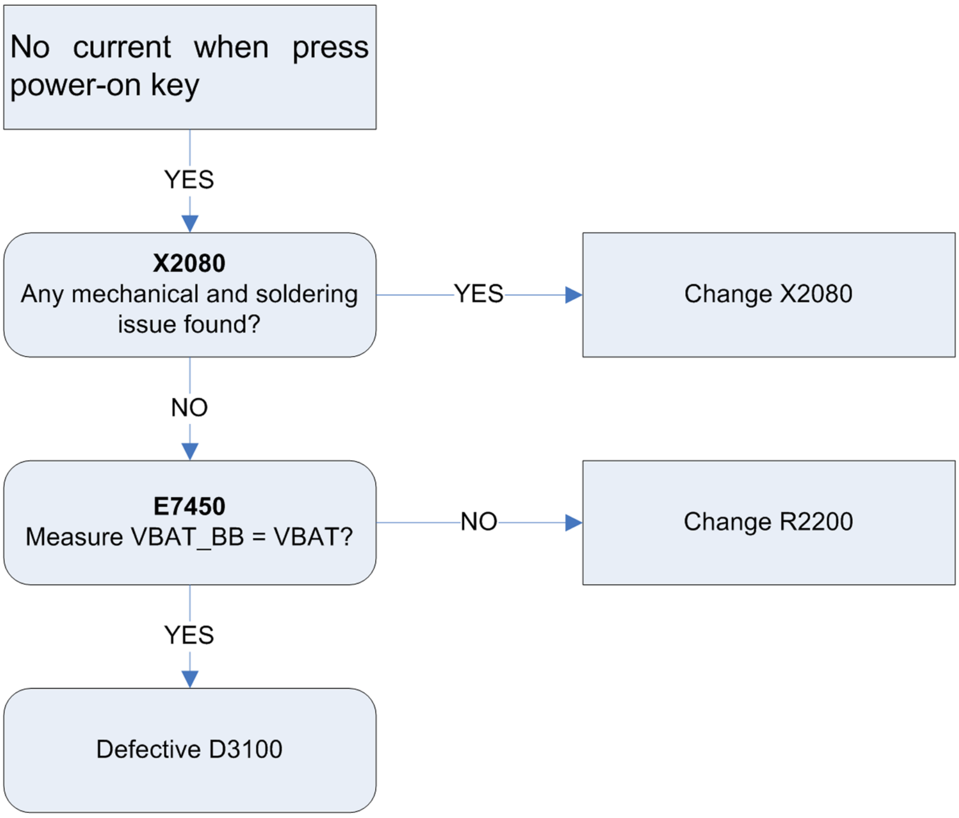


Figure 12 No current when pressing power on key

Clocking system troubleshooting

26 MHz clock does not work

If the 26 MHz crystal does not work, it may be due to B7100 malfunction or a soldering defect.

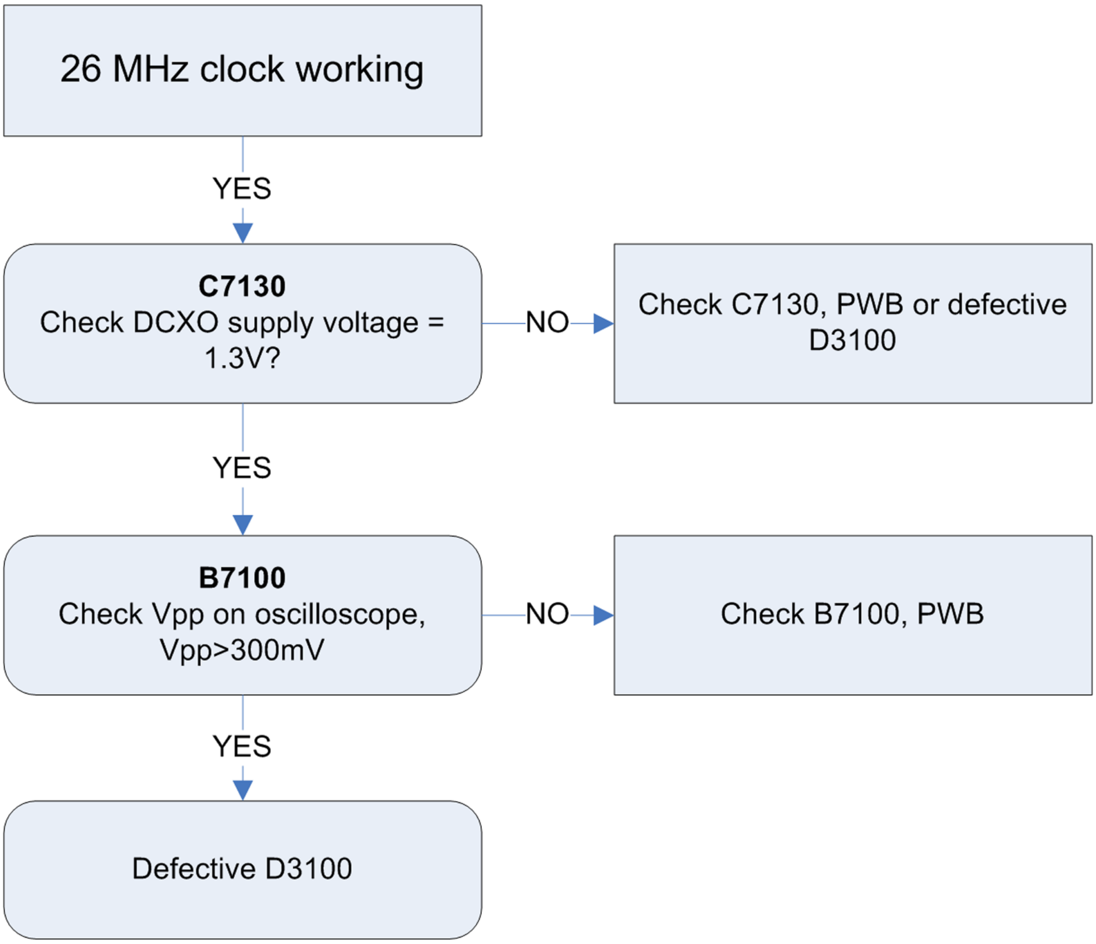


Figure 13 26 MHz Clock does not work

32 KHz RTC clock does not work

If the 32 KHz crystal does not work, it may be due to B3000 malfunction, matching capacitor or B3000 soldering defect.

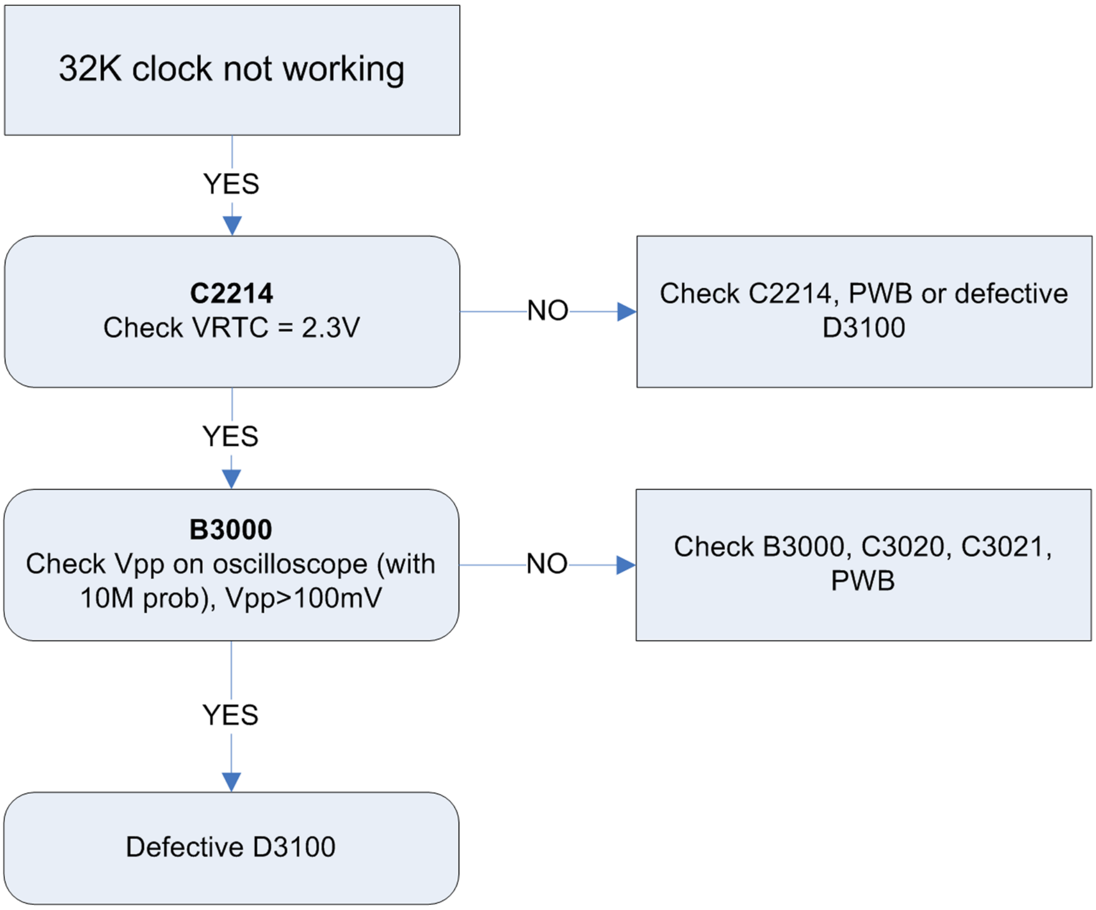


Figure 14 32 KHz RTC clock does not work

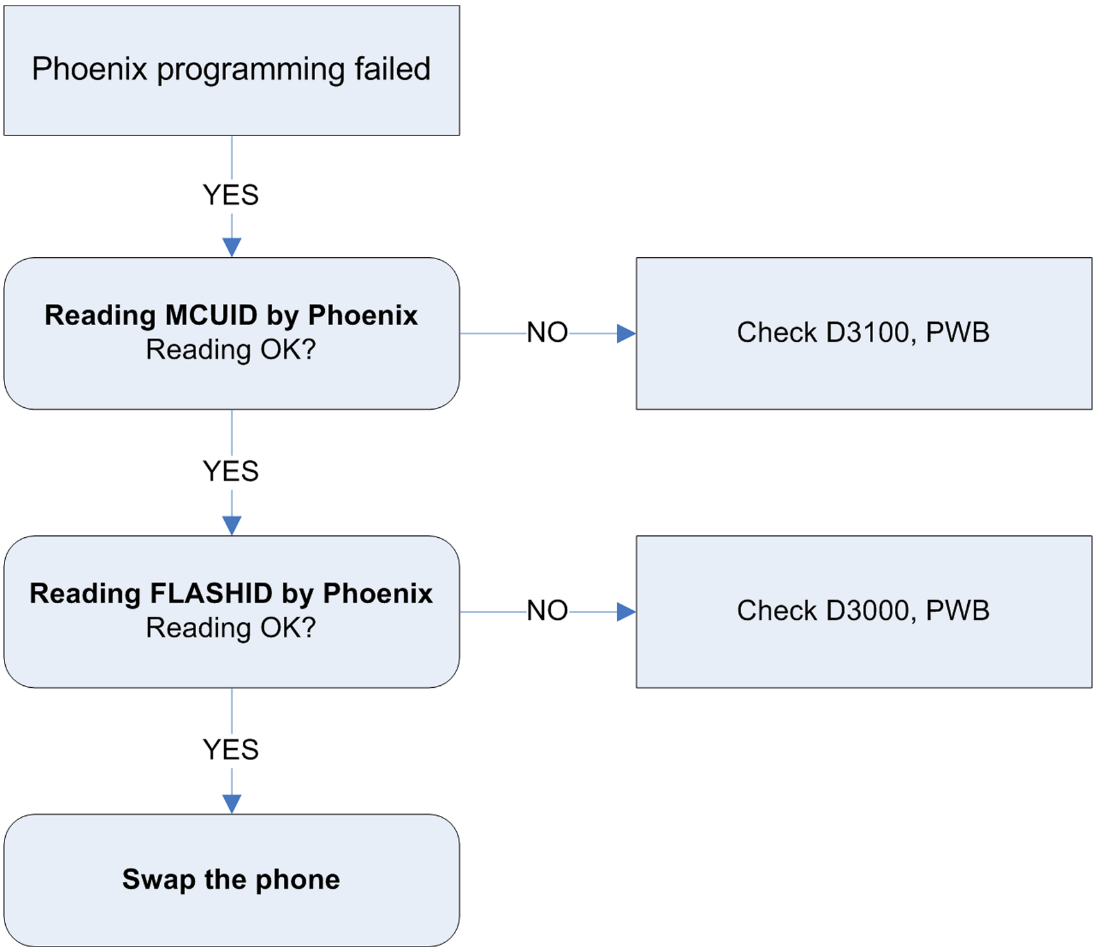
Flash programming troubleshootin

Context

Flash programming can be done via the USB test points or the USB connector. If there is a connectivity issue (open/short circuit) under BGA chip, it may also cause programming failure. It is assumed that the integrity of the USB connection is verified prior to flashing troubleshooting.

The Phoenix tool can give some useful information about the failure as indicated in the following programming troubleshooting flow.

Troubleshooting flow

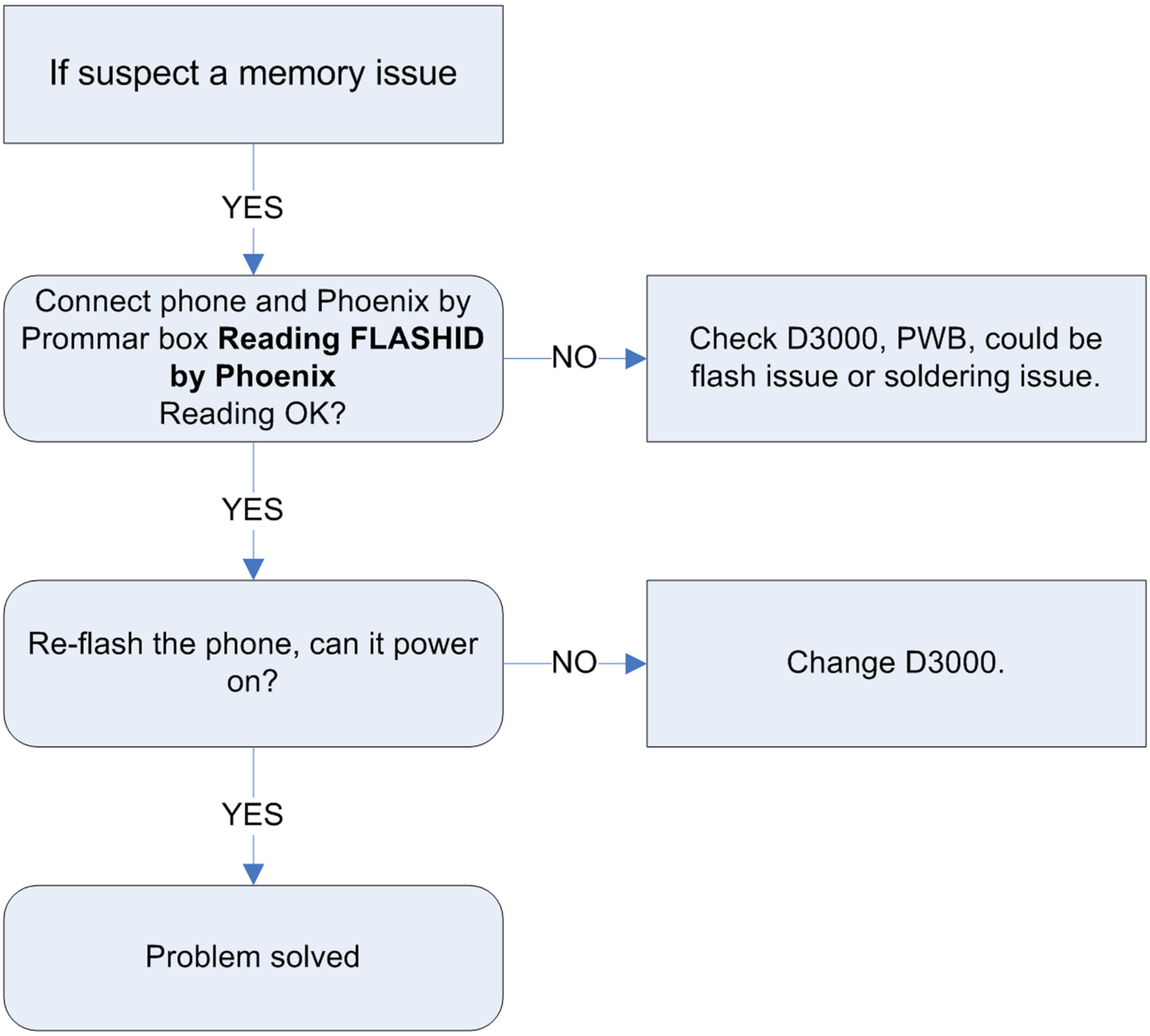


Main memory troubleshooting

Context

Possible issues happen on the main memory could be: image corruption, soldering issue or flash chip damaged.

Troubleshooting flow



Charging troubleshooting

Can not identify charger

When inserting the wall adaptor into the phone, the phone will detect a valid voltage if charger output voltage is 4.6 – 9.3V. But if something is wrong with the voltage detect/measurement circuit, then the phone cannot correctly identify the charger.

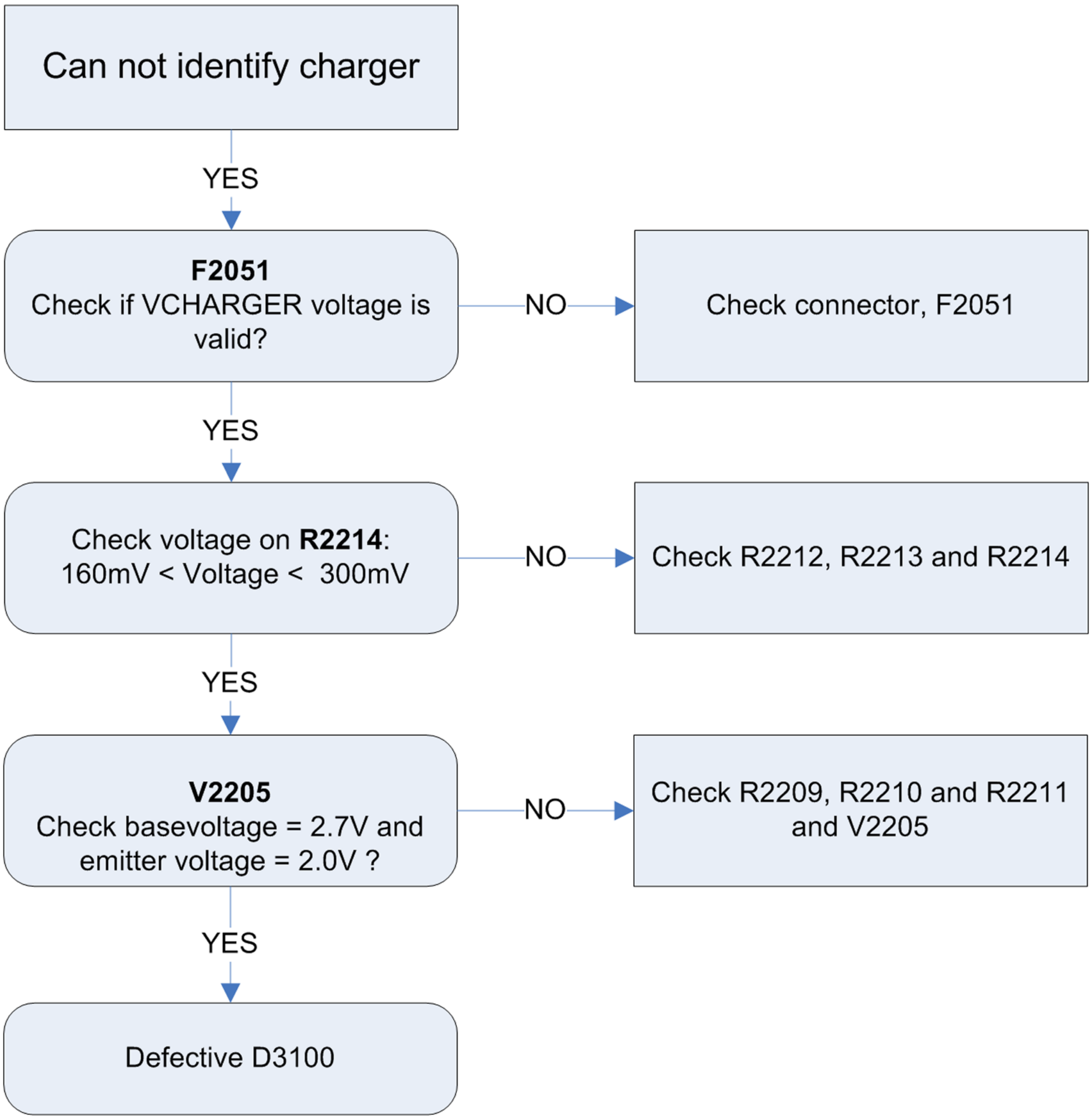


Figure 15 Cannot identify charger

No charging current (cannot charge battery fully in expected time)

When the phone is in constant current or constant voltage charge state, the average charging current is controlled by phone SW. The current is feed into battery though the V2204 transistor, the phone measures charging current by sampling the voltage over resistor R2208. If there is something wrong at this path, the charging current may be out of specification. It is assumed that phone can detect the presence of the charger, otherwise please refer to the above section.

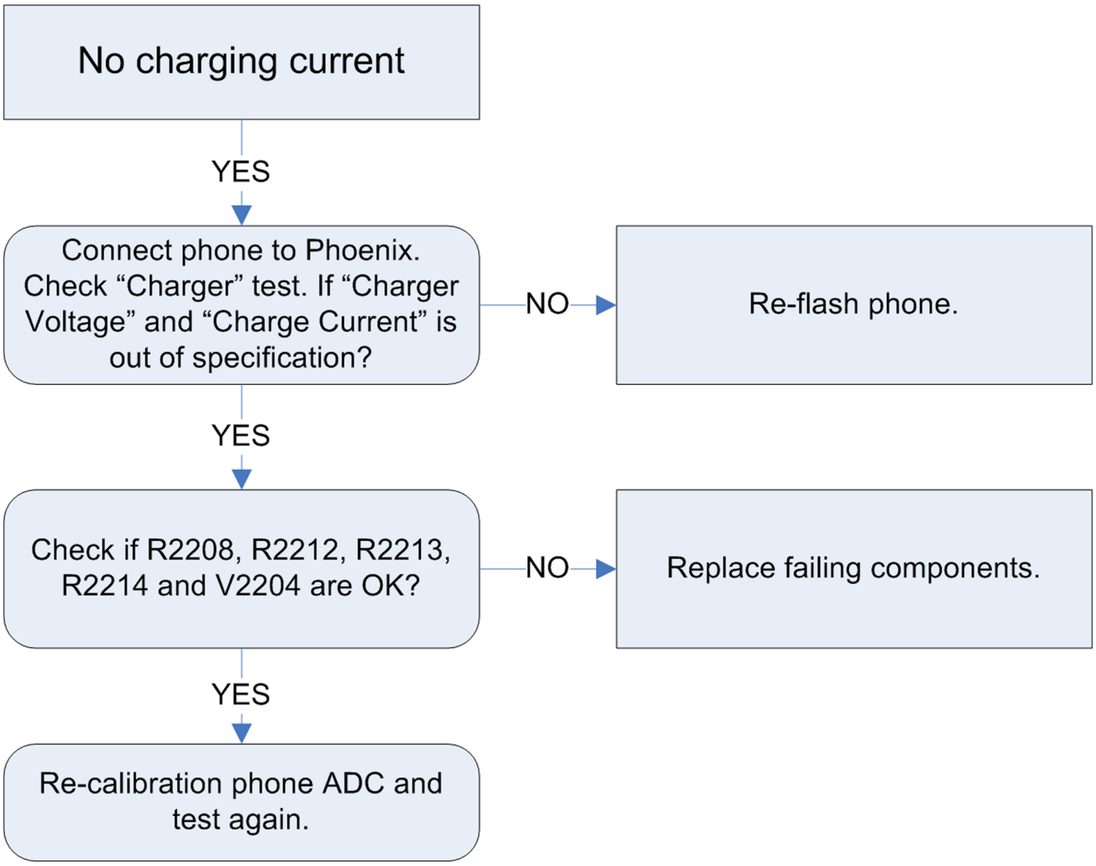


Figure 16 No charging current

SIM card troubleshooting

Cannot identify SIM card

The hardware of the SIM interface from XGOLD213 (D3100) to the SIM connector (X2750) can be tested without a SIM card. When the phone is switched on, the phone first checks for a 1.8V SIM card, and then for a 3V SIM card. The phone will try this several times, where after it will display "Insert SIM card".

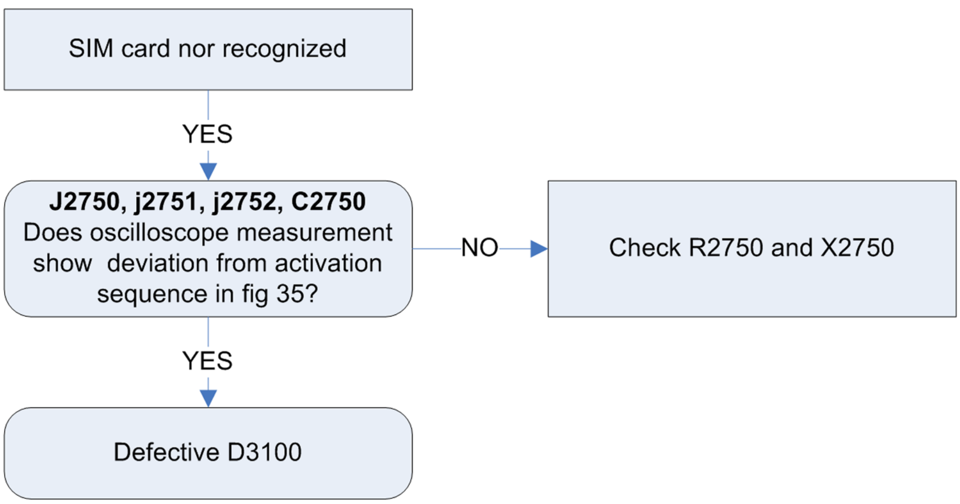


Figure 17 Cannot identify SIM card

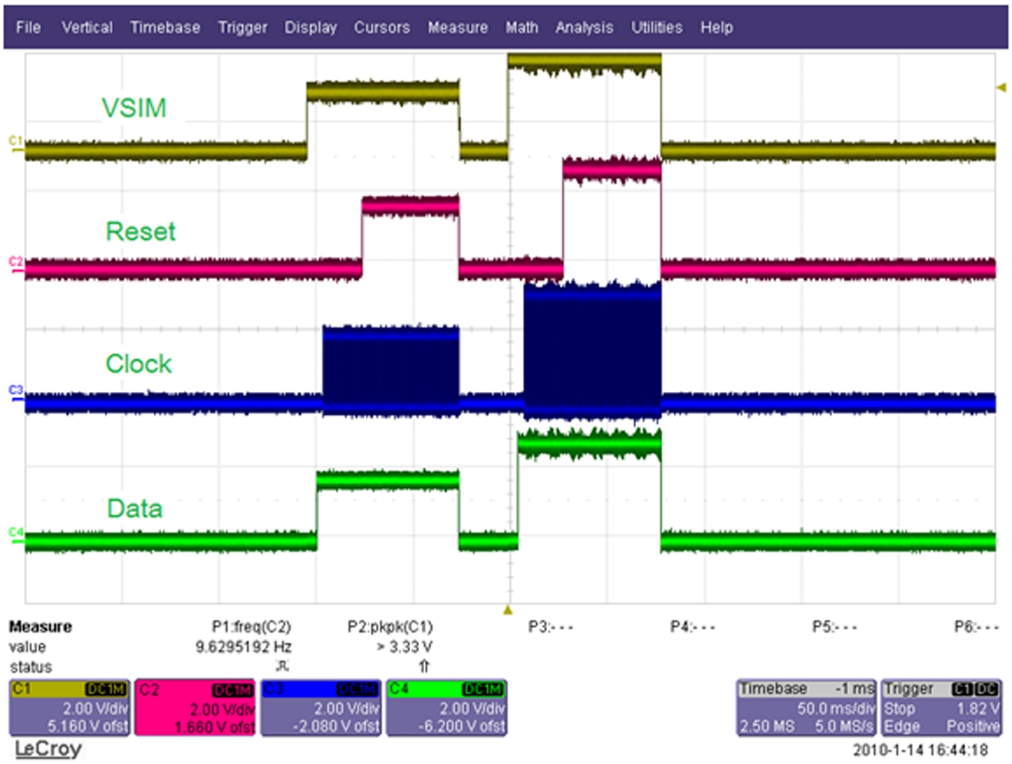


Figure 18 SIM voltages, no ATR

SIM card rejected

The error "SIM card rejected" means that the ATR message received from SIM card is corrupted, e.g. data signal levels are wrong. The first data is always ATR and it is sent from card to phone. For reference a picture with normal SIM power-up is shown below.

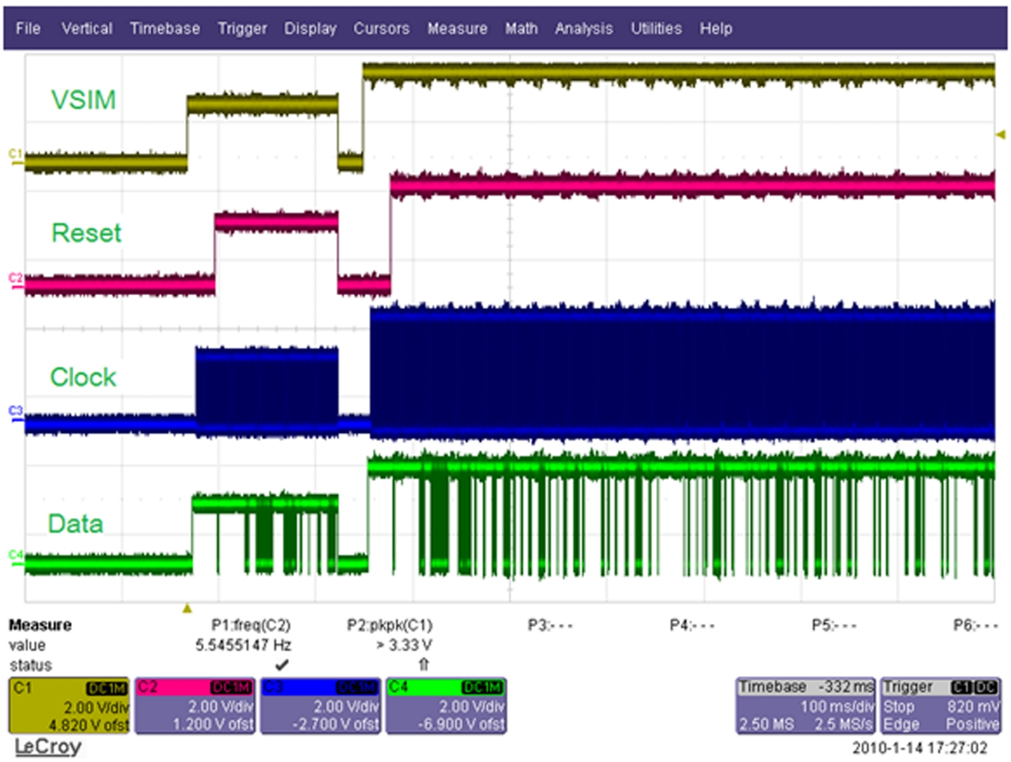


Figure 19 SIM voltages, normal startup at 3V

Dual SIM troubleshooting

Troubleshooting SIM problems on a dual SIM product is very similar to the procedures outlined in the above section. The presence of the dual SIM IC is detected by the self-test routine, and as such it can be assumed that presence and interface towards the BB IC is verified if the self-test passes. The troubleshooting guides will as a consequence focus on dual SIM IC <-> SIM card related problems. It also assumed that troubleshooting on SIM1 is done using only one SIM card, which is inserted either in slot 1, and troubleshooting on SIM2 is done using 2 SIM cards, so both slots needs to be occupied.

SIM 1 not recognized

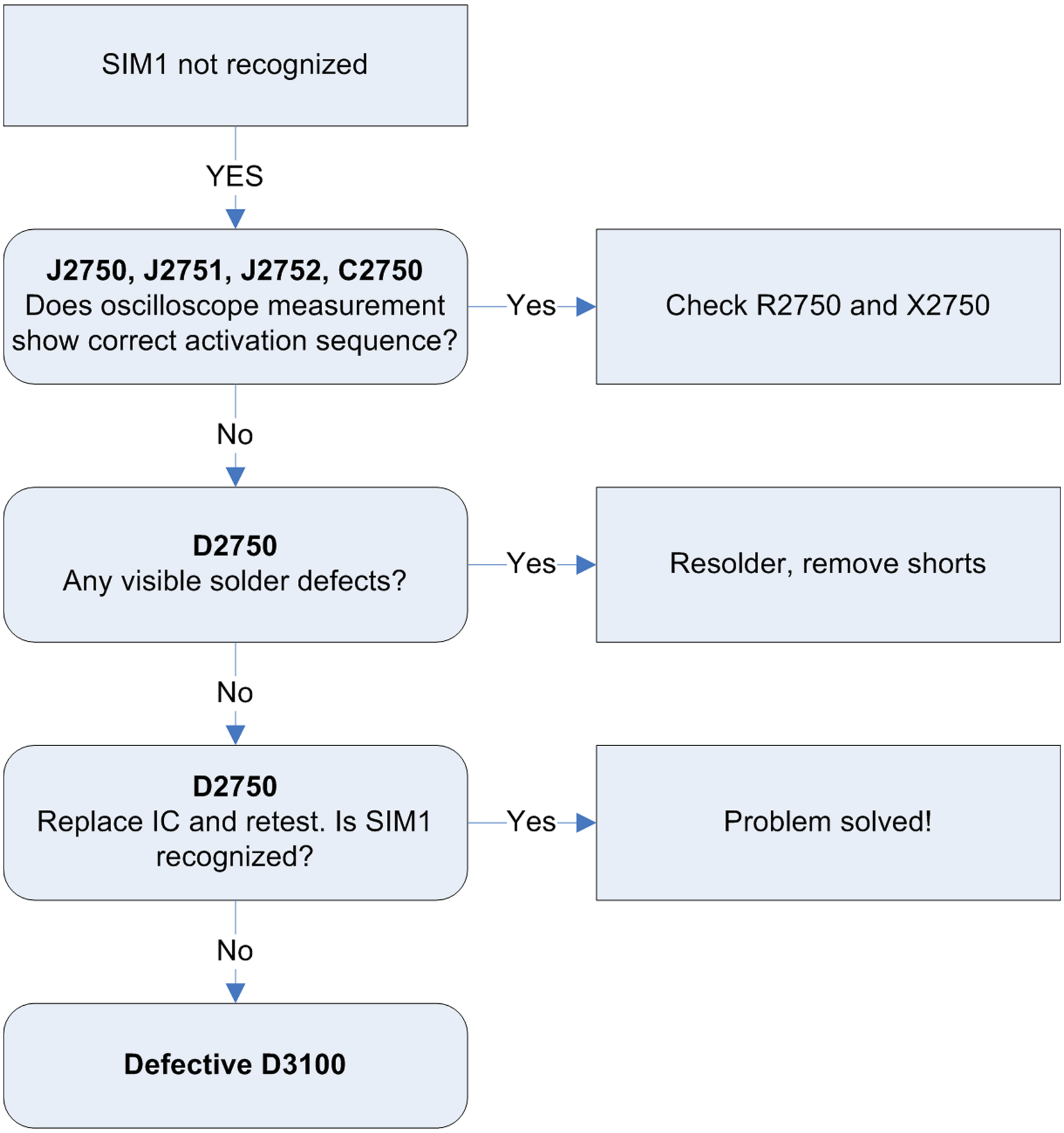


Figure 20 SIM 1 troubleshooting flow

SIM 2 not recognized

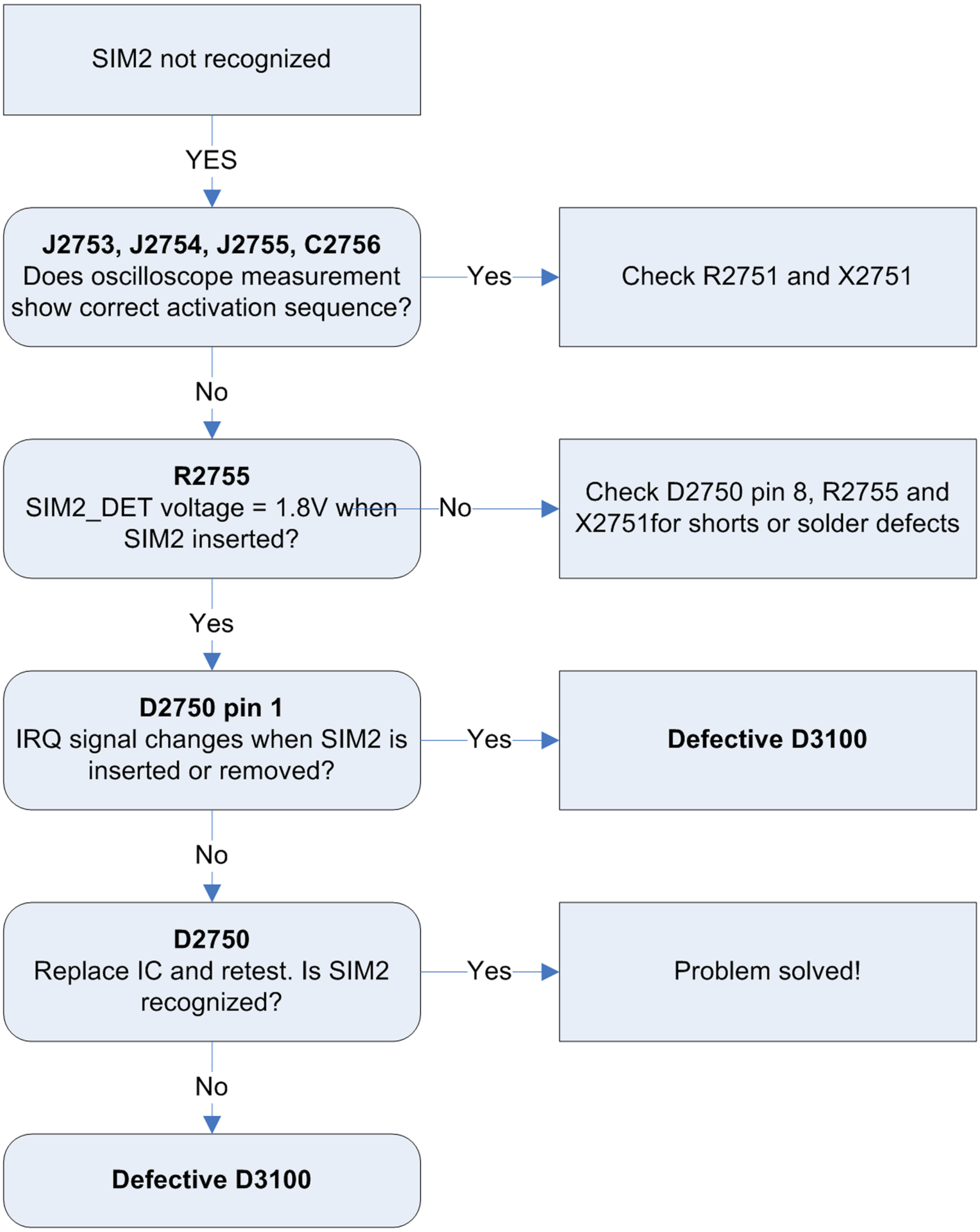


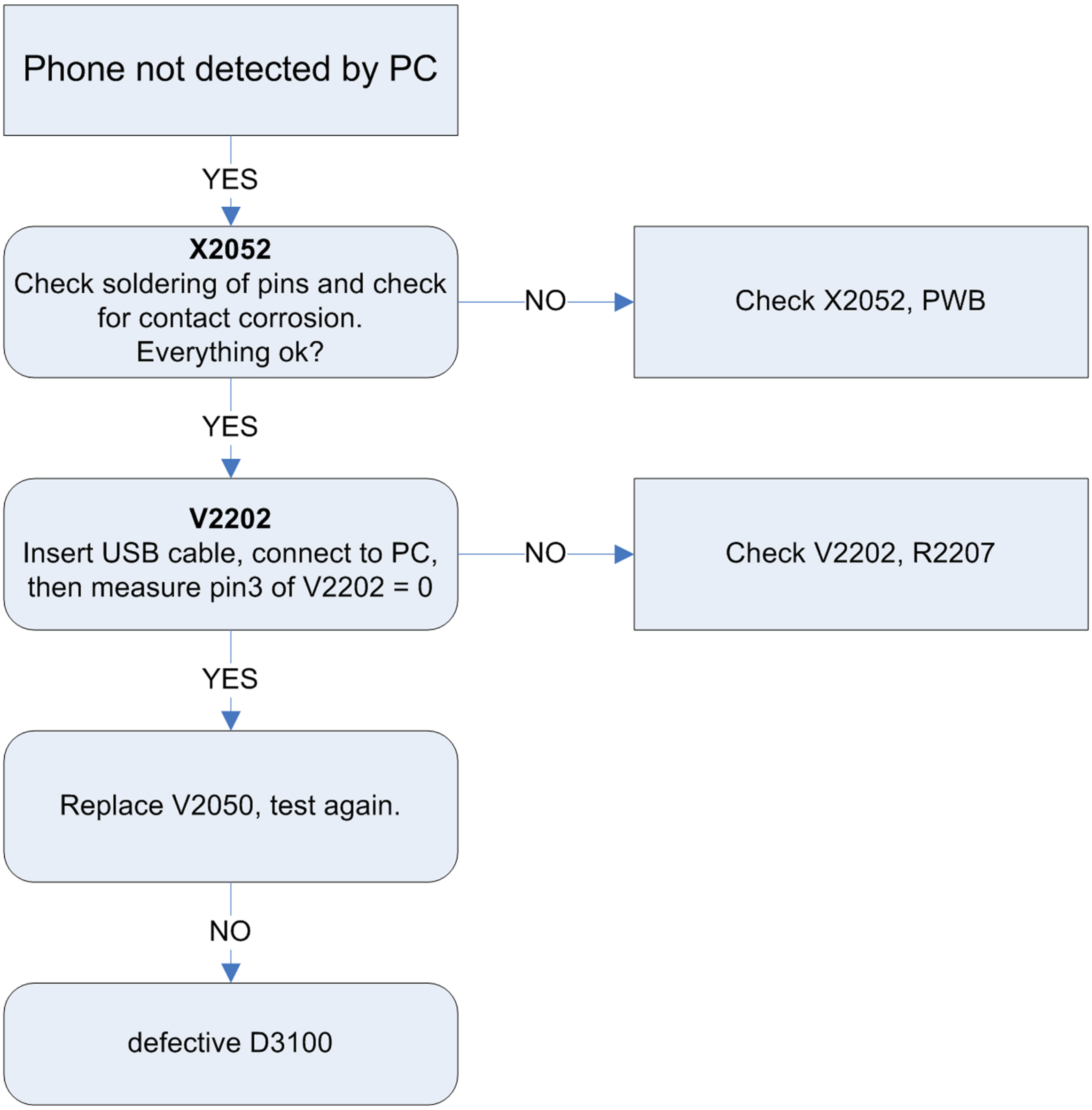
Figure 21 SIM 2 troubleshooting flow

USB troubleshooting

Context

If the phone cannot be detected by PC when the USB cable is inserted, this means that communication between phone and PC can not be setup. This may be due to soldering issue or a malfunction in the ESD protection device.

Troubleshooting flow



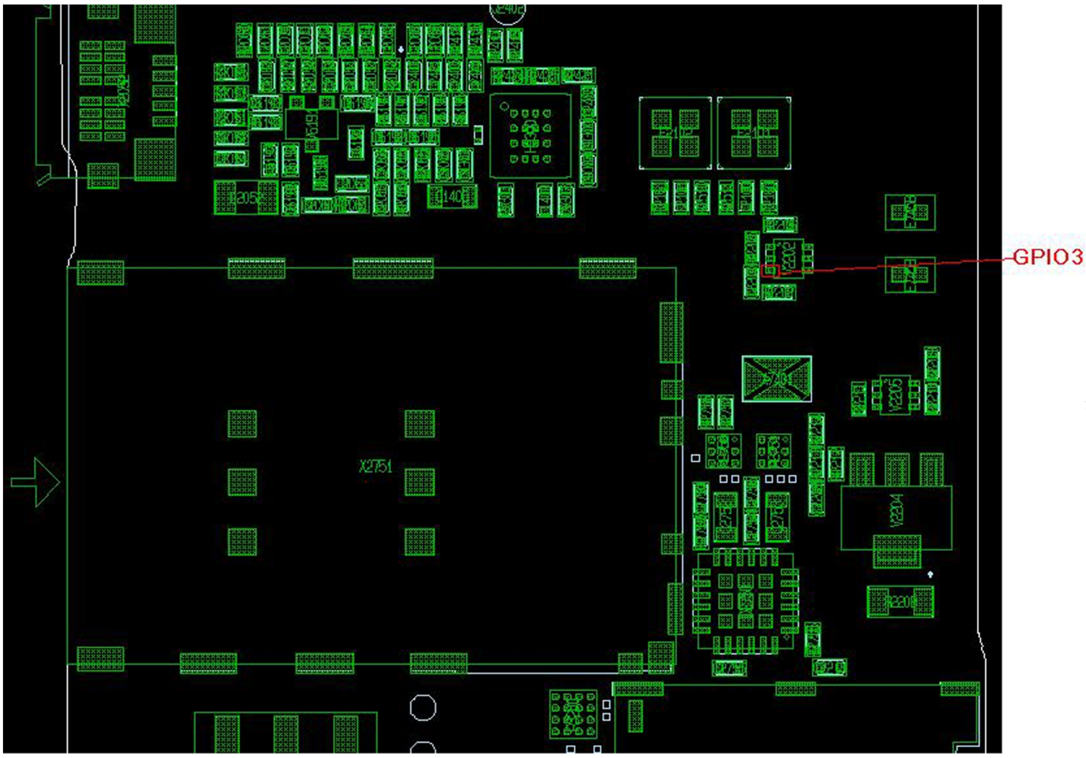


Figure 22 Pin 3 of V2202

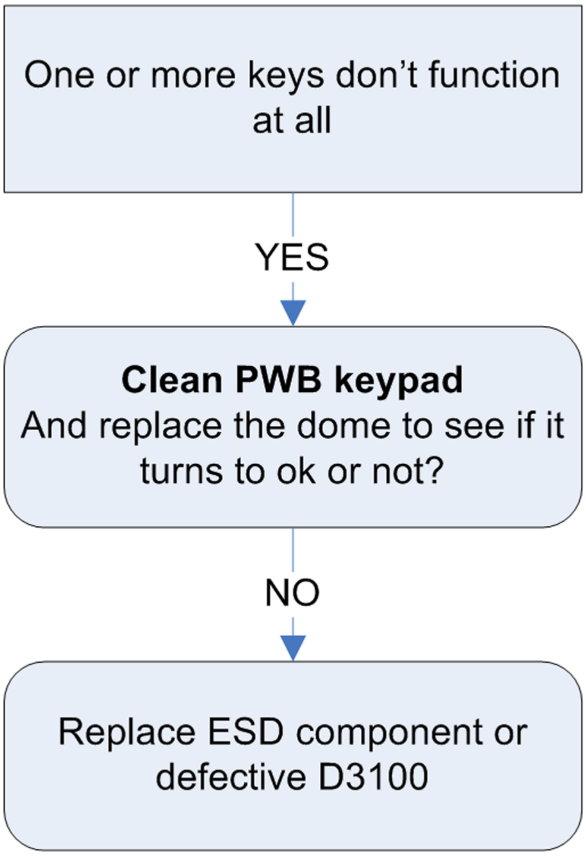
User interface troubleshooting

Keyboard troubleshooting

Context

One or more keys don’t function at all.

Troubleshooting flow



Display troubleshooting

Blank display

The display doesn't show any information at all when phone is powered on. XGOLD connects the LCD via the serial port. If the communication between XGOLD and LCD has problems, the XGOLD may be not be able to initialize LCD correctly. The XGOLD also feeds 2 power supplies to the LCD: VAUX and 1V8, if these 2 power supply work abnormally, the LCD also doesn't work.

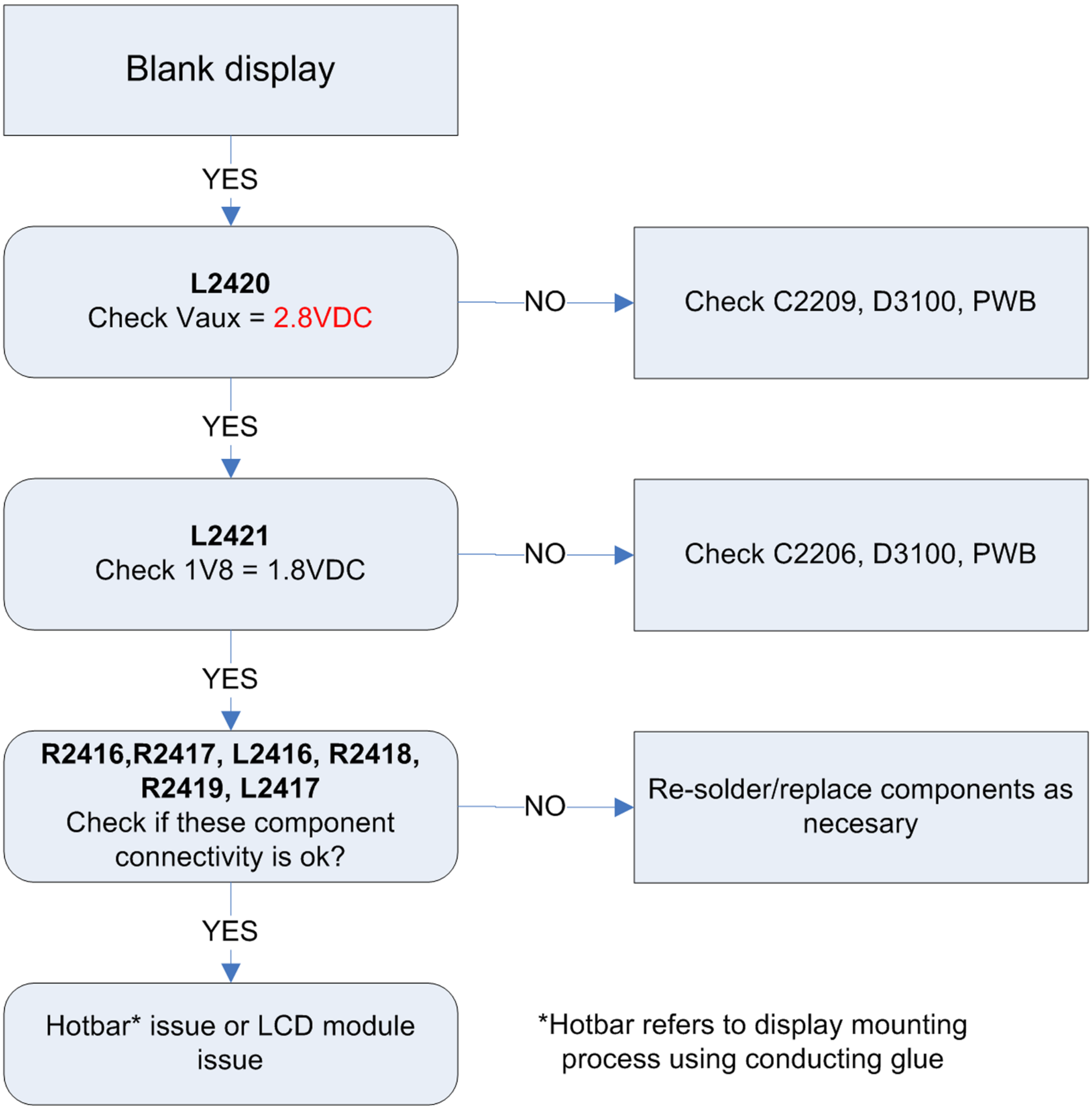


Figure 23 Blank display troubleshooting flow

Display is corrupt

The display contains missing or fading segments or color presentation is incorrect. Since ACF assembling is used, it cannot be repaired.

Backlight troubleshooting

No backlight

The backlight is driven by a DC-DC converter. The LCD backlight LED's and the keypad LED's are in connected in serial path. If any component on this serial path is open circuit, there is no backlight.

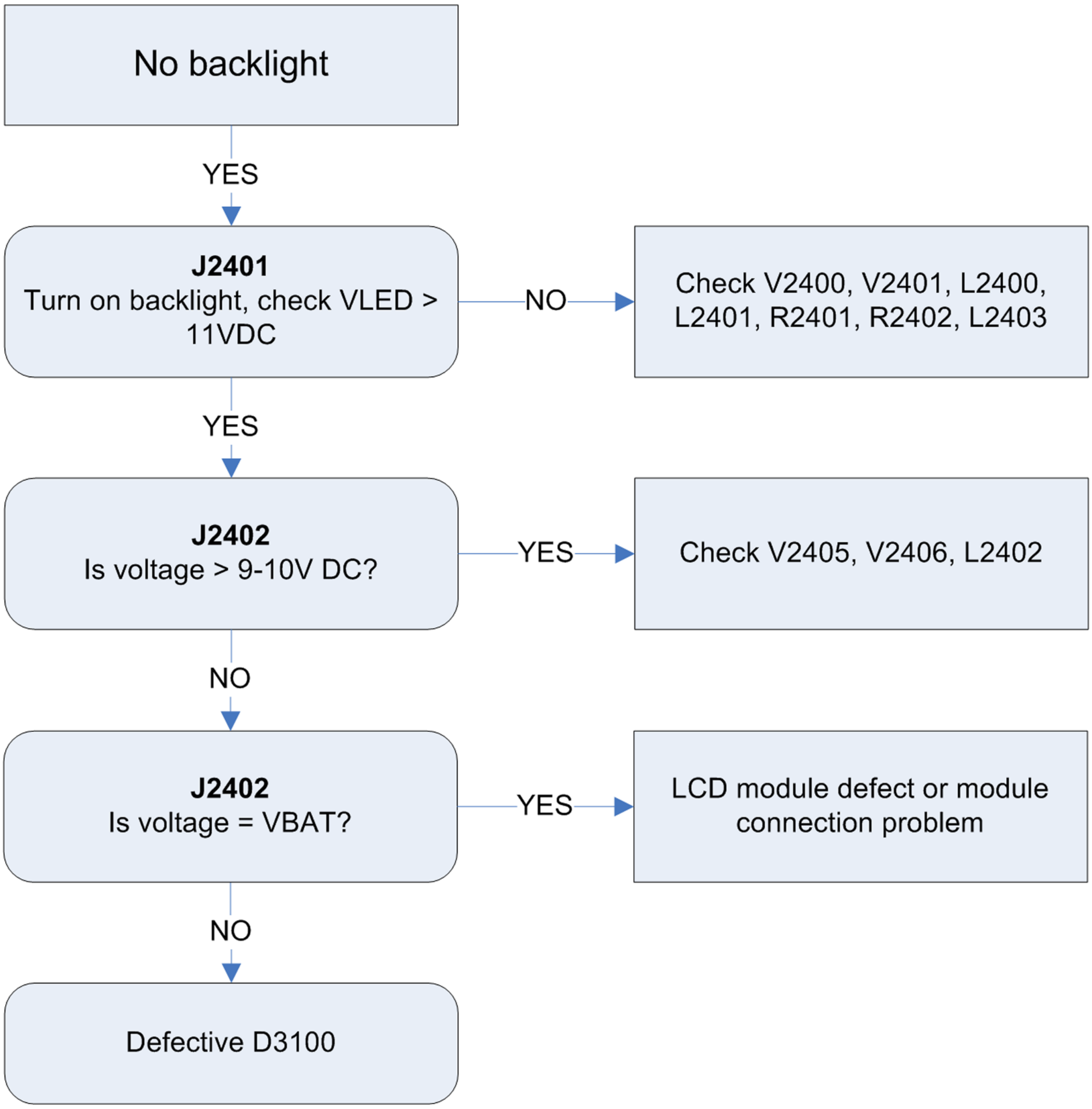


Figure 24 No backlight troubleshooting flow

Camera interface troubleshooting

Camera troubleshooting instructions

Camera troubleshooting involves debugging on two interfaces; the interface between the camera module itself and the camera interface IC N3000, and debugging on the interface between N3000 and the baseband IC D3100. Troubleshooting on interface between camera and N3000 is outside the scope of this specification. In the following troubleshooting guide it is assumed that the integrity of this interface is already verified and valid signal are present on the inputs of N3000.

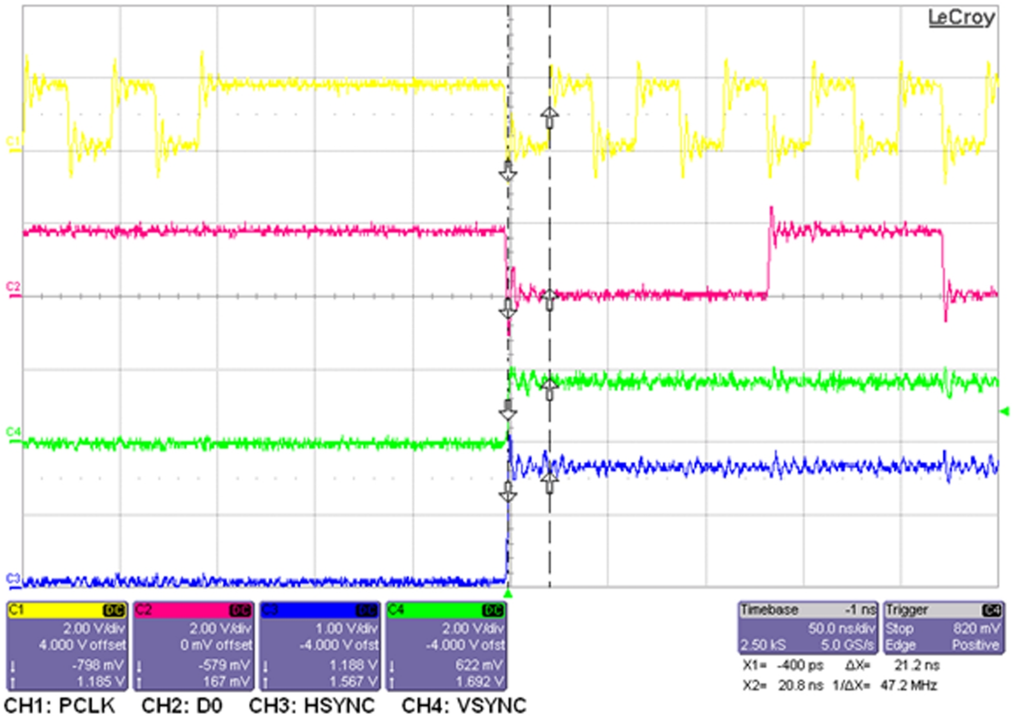


Figure 25 Interface signals between D3100 and N3000

The above figure shows the interface signals between N3000 and D3100 when the camera is active:

Yellow: Pixel Clock signal J3002

Red: Data bit 0 J3003

Green: Hsync J3005

Blue: Vsync J3006

Actual pixel clock frequency, Vsync and Hsync frequency and data content will depend on the camera used (resolution, frame-rate) and operating mode (still picture capture, video recording, viewfinder mode).

No valid data from Camera interface IC

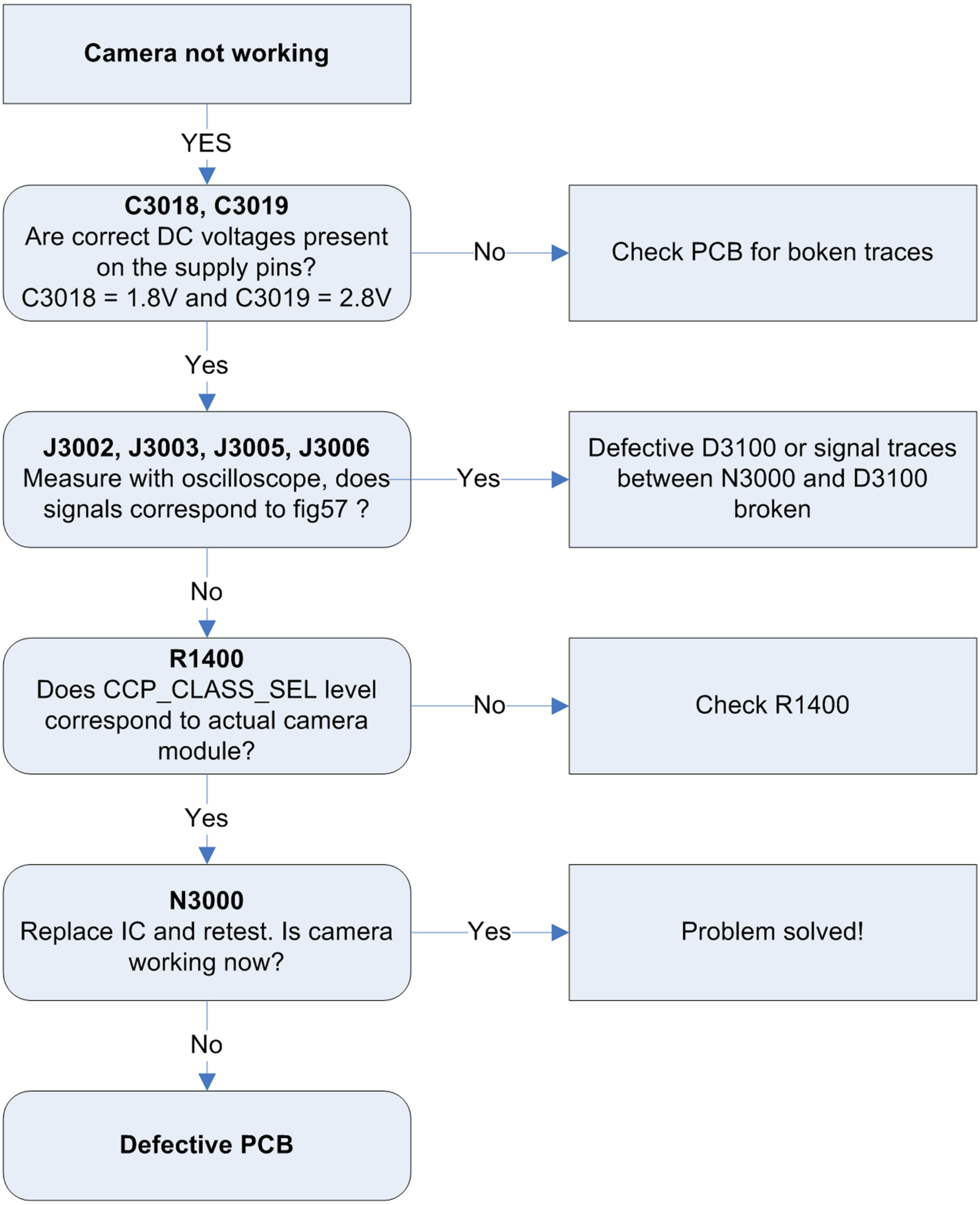


Figure 26 Camera interface IC troubleshooting guide

Configuration of the camera interface chip IC:

CCP_CLASS_SEL = GND: SMIA Class 0, Strobe pins functions as Clock inputs (ACME VGA module)

CCP_CLASS_SEL = 1.8V: SMIA Class 1, Strobe and Data. (2MP Gandalf module)

Audio troubleshooting

Audio troubleshooting test instructions

Audio troubleshooting using phoenix:

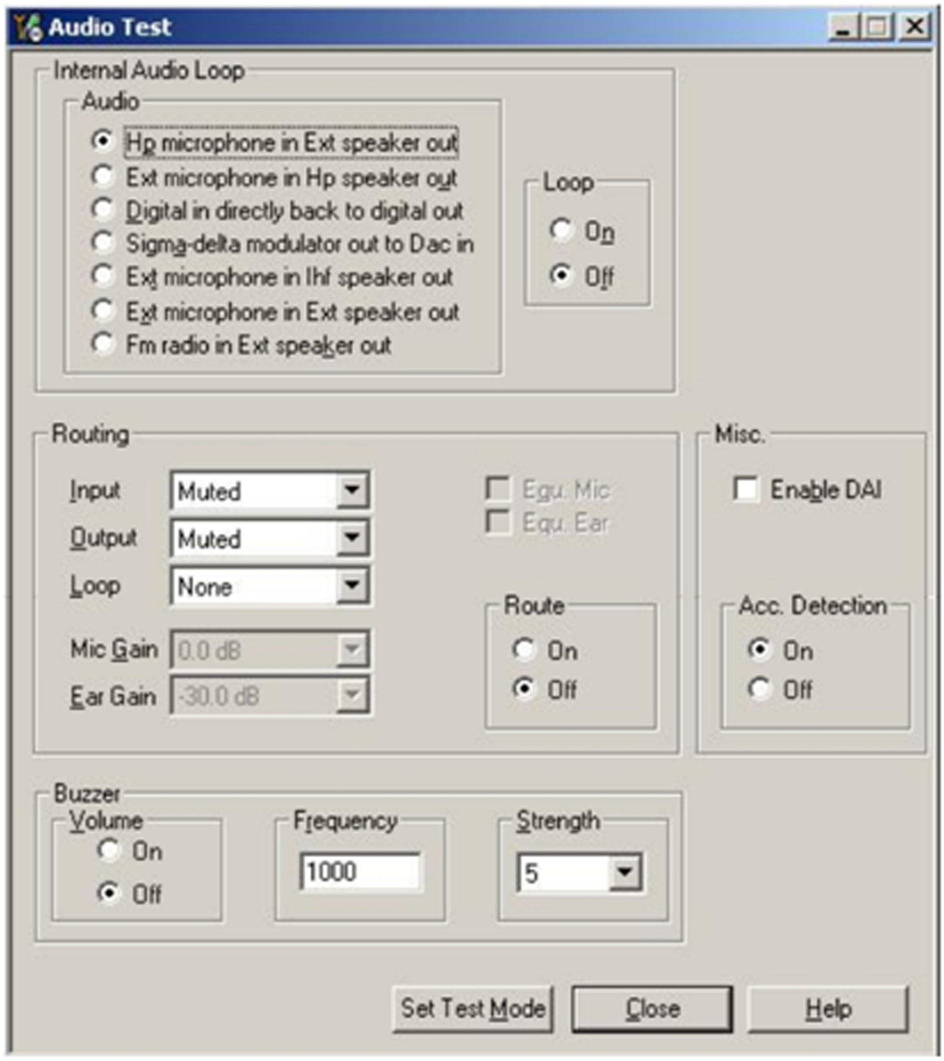


Figure 27 Phoenix audio test window

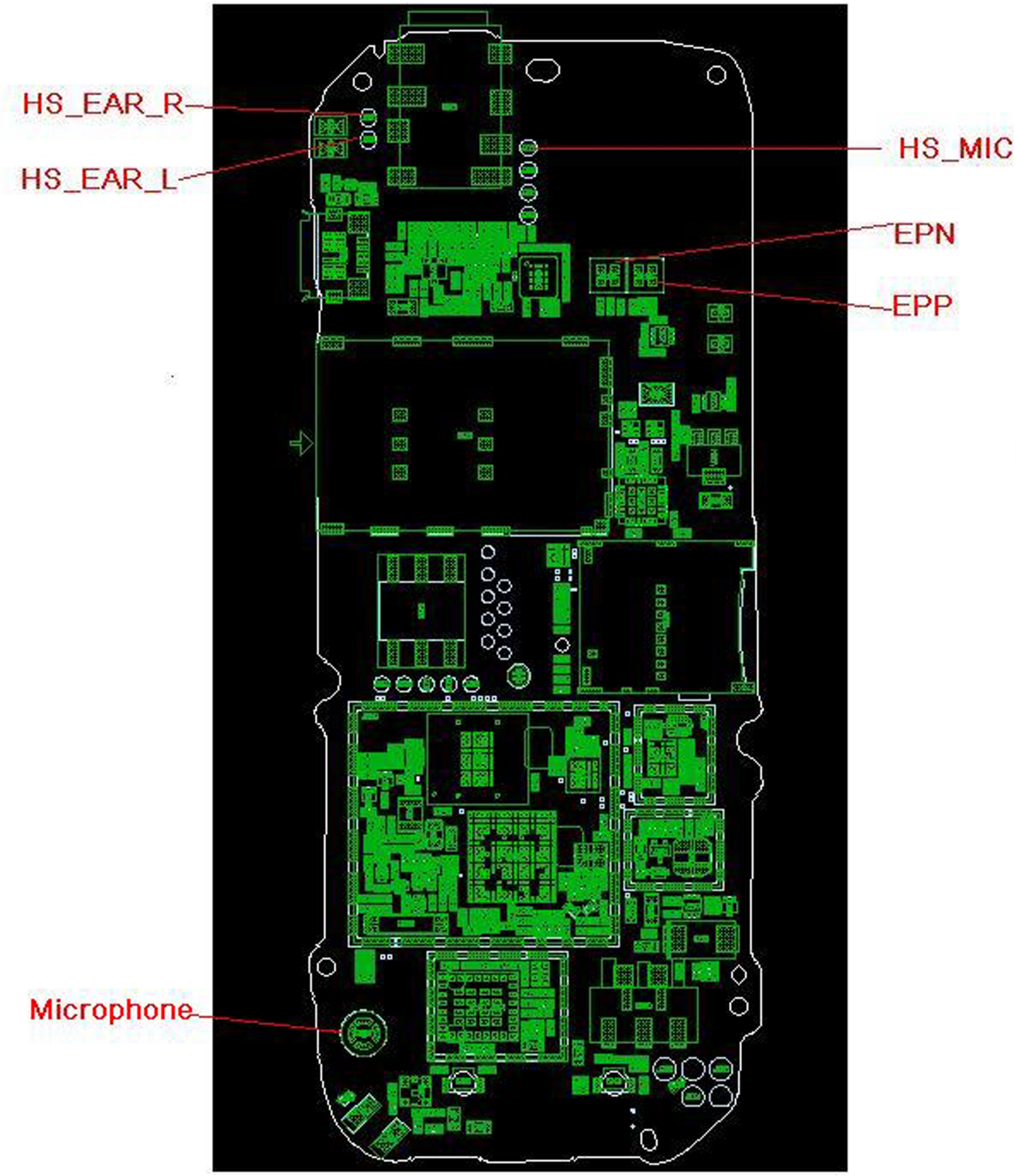


Figure 28 PWB audio test point

Internal microphone troubleshooting

Steps:

1. Connect phone with Phoenix.
2. Open "audio test" window from "Testing –> Audio test", as shown in Figure Phoenix audio test window above.
3. Select "Hp microphone in Ext speaker out".

4 Select “Loop” as “On”.
5 Input sound at microphone port, for example 94dB SPL 1kHz.
6 Check if signal is detected at HS_EAR_L/R pads, as shown in Figure “PWB audio test points” above.

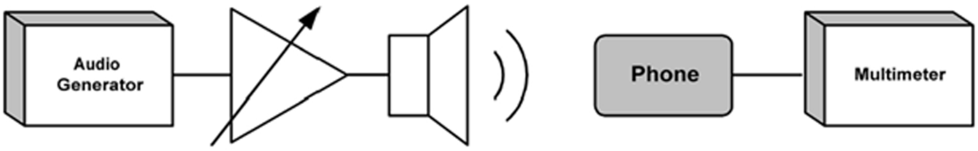


Figure 29 Test arrangement for microphone

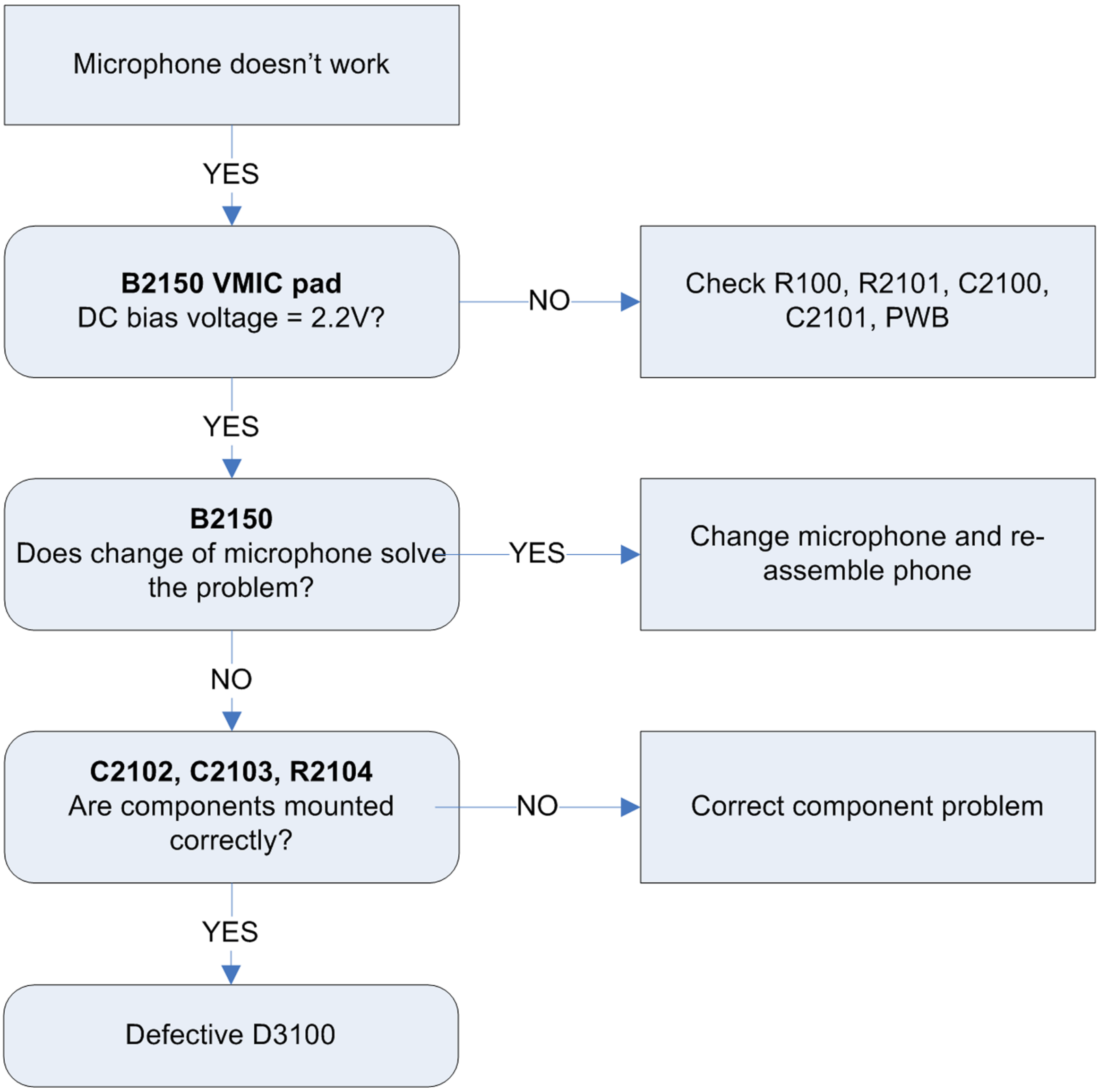


Figure 30 Internal microphone troubleshooting flow

Internal earpiece troubleshooting

Steps:

1 Connect phone with Phoenix.
2 Open “audio test” window from “Testing –> Audio test”, as shown in Figure Phoenix audio test window above.
3 Select “Ext microphone in Hp speaker out”.
4 Select “Loop” as “On”.
5 Input signal to HS_MIC/GND pads, as shown in Figure PWB audio test point above, for example 100mVpp, 1kHz.
6 Check if sound is heard in earpiece.

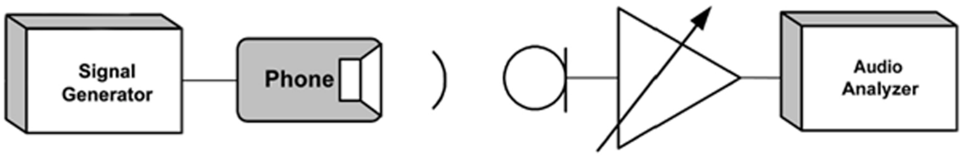


Figure 31 Test arrangement for earpiece

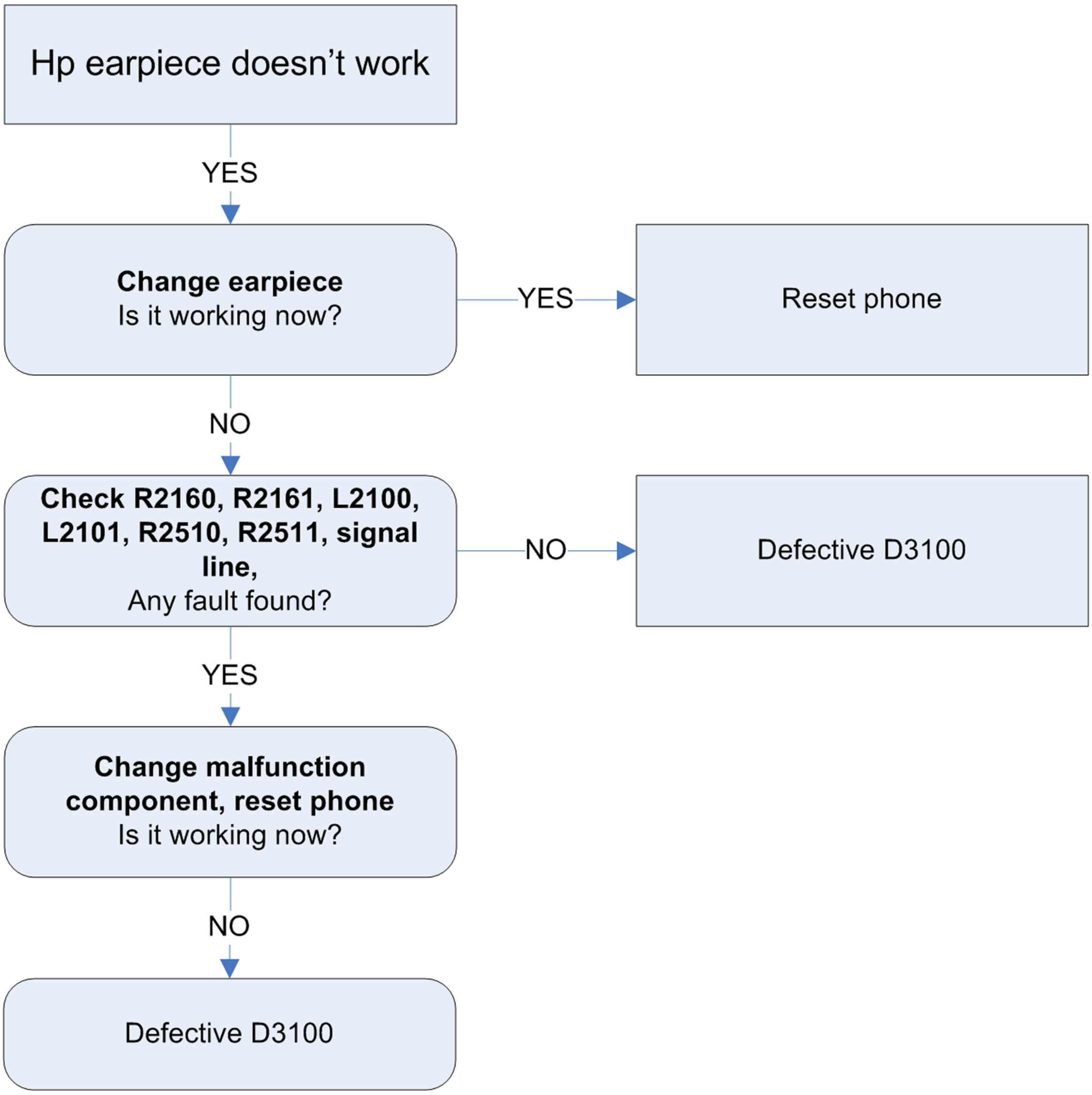


Figure 32 Internal earpiece troubleshooting flow

IHF speaker troubleshooting

Steps:

1 Connect phone with Phoenix.

2 Open "audio test" window from "Testing –> Audio test", as shown in Figure Phoenix audio test window above.

3 Select "Ext microphone in IHF speaker out".

4 Select "Loop" as "On".

5 Input signal to HS_MIC/GND pads, as shown in Figure PWB audio test point above, for example 100mVpp, 1kHz.

6 6) Check if sound is heard in IHF.

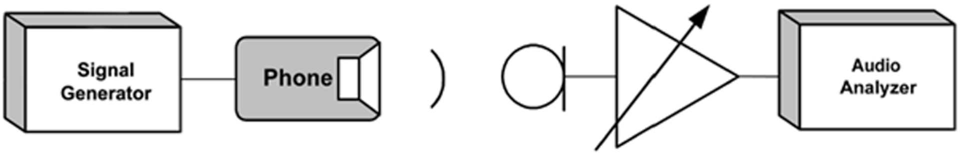


Figure 33 Test arrangement for IHF speaker

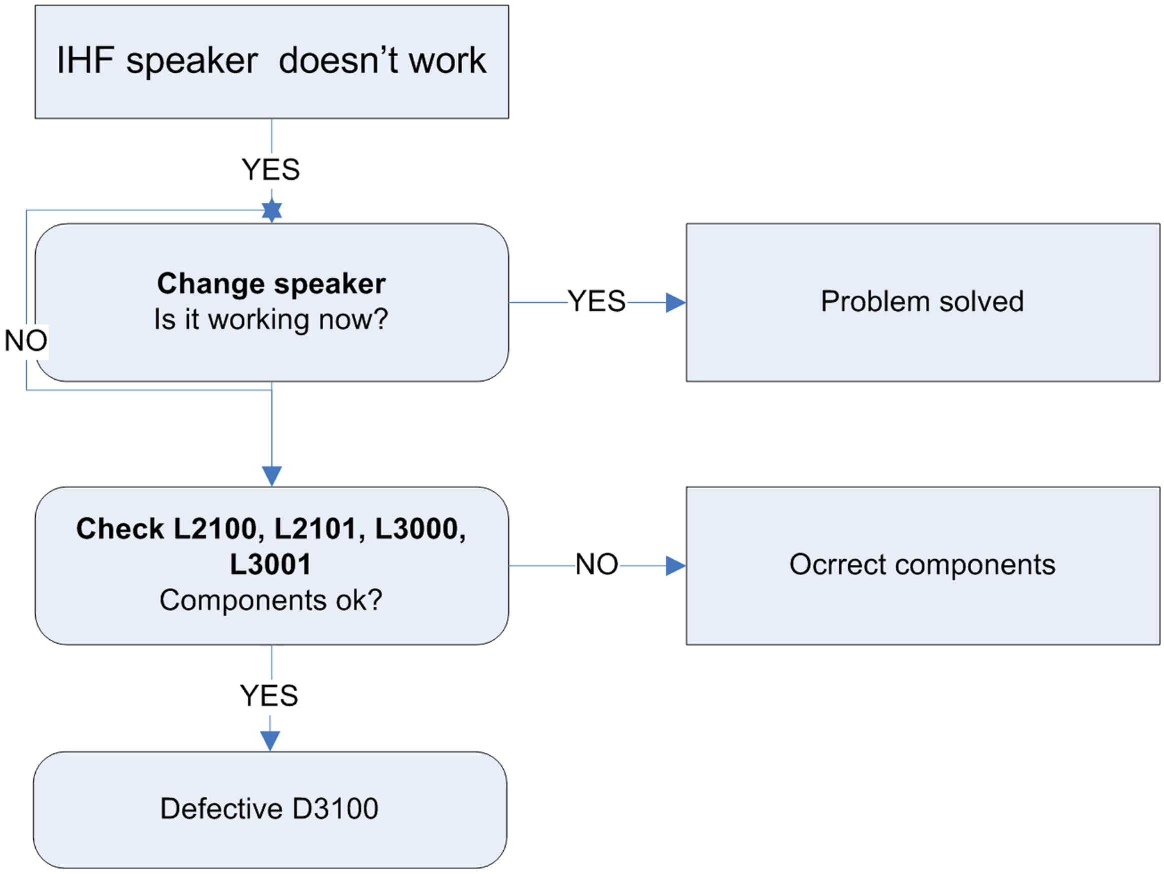


Figure 34 IHF speaker troubleshooting flow

External microphone troubleshooting

Steps:

1 Connect phone with Phoenix.
2 Open "audio test" window from "Testing –> Audio test", as shown in Figure Phoenix audio test window above.
3 Select "Ext microphone in Ext speaker out".
4 Select "Loop" as "On".
5 Input sound at microphone port, for example 94dB SPL 1kHz.
6 Check if signal is detected at HS_EAR_L/R pads, shown in Figure PWB audio test points above.

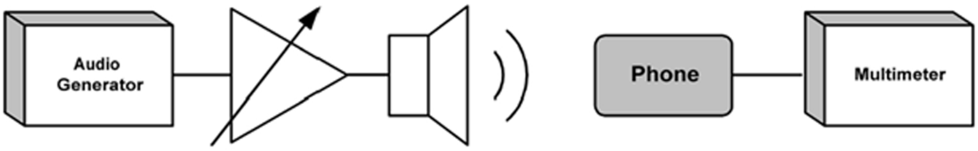


Figure 35 Test arrangement for external microphone

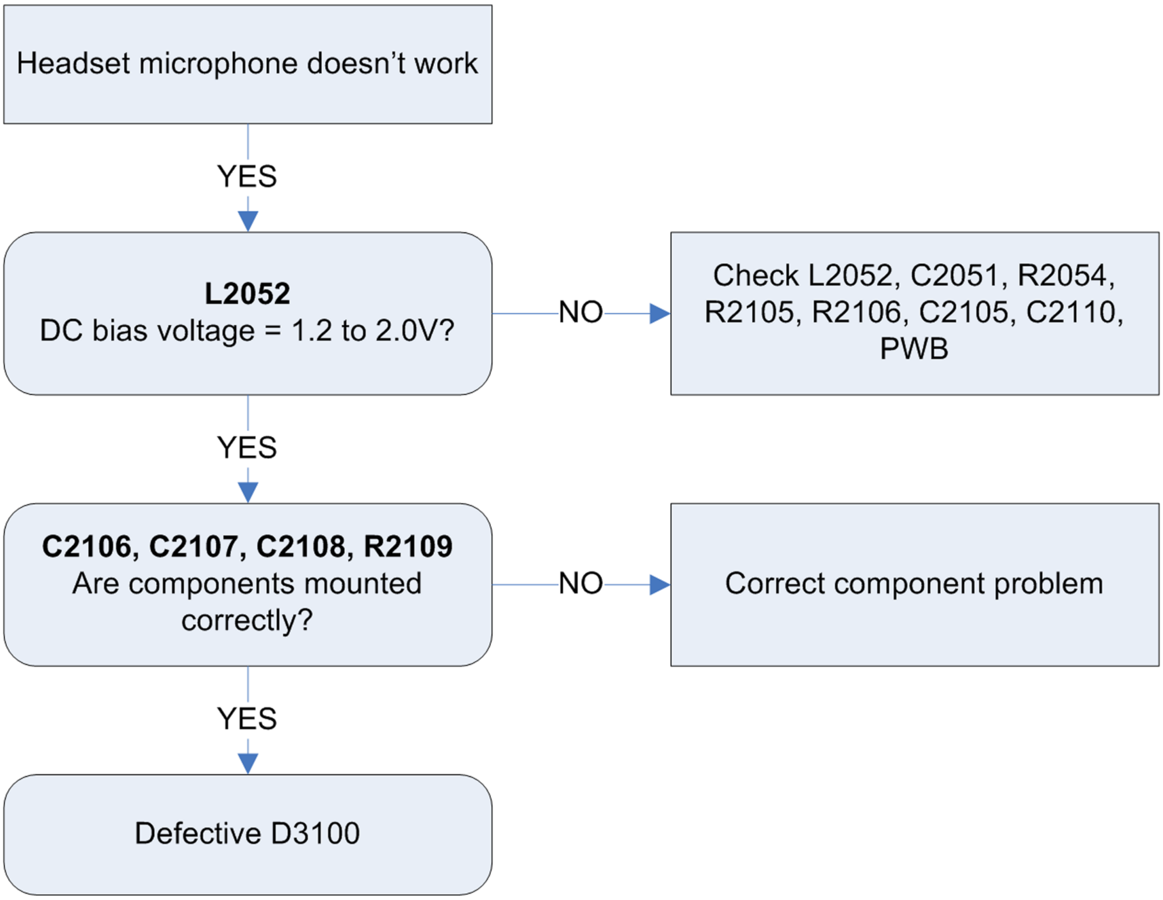


Figure 36 external microphone troubleshooting flow

Headset speaker troubleshooting

Steps:

1 Connect phone with Phoenix.
2 Open "audio test" window from "Testing -> Audio test", as shown in Figure Phoenix audio test window above.
3 Select "Ext microphone in Ext speaker out".
4 Select "Loop" as "On".
5 Input signal to HS_MIC/GND pads, as shown in Figure PWB audio test point above, for example 100mVpp, 1kHz.
6 Check if sound is heard in headset.

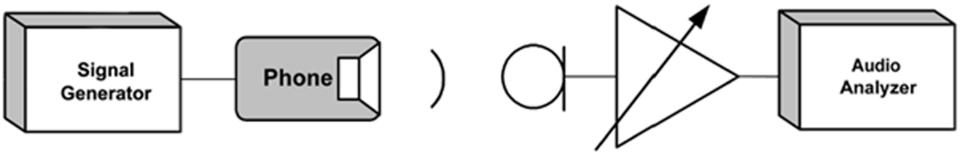


Figure 37 Test arrangement for headset speaker

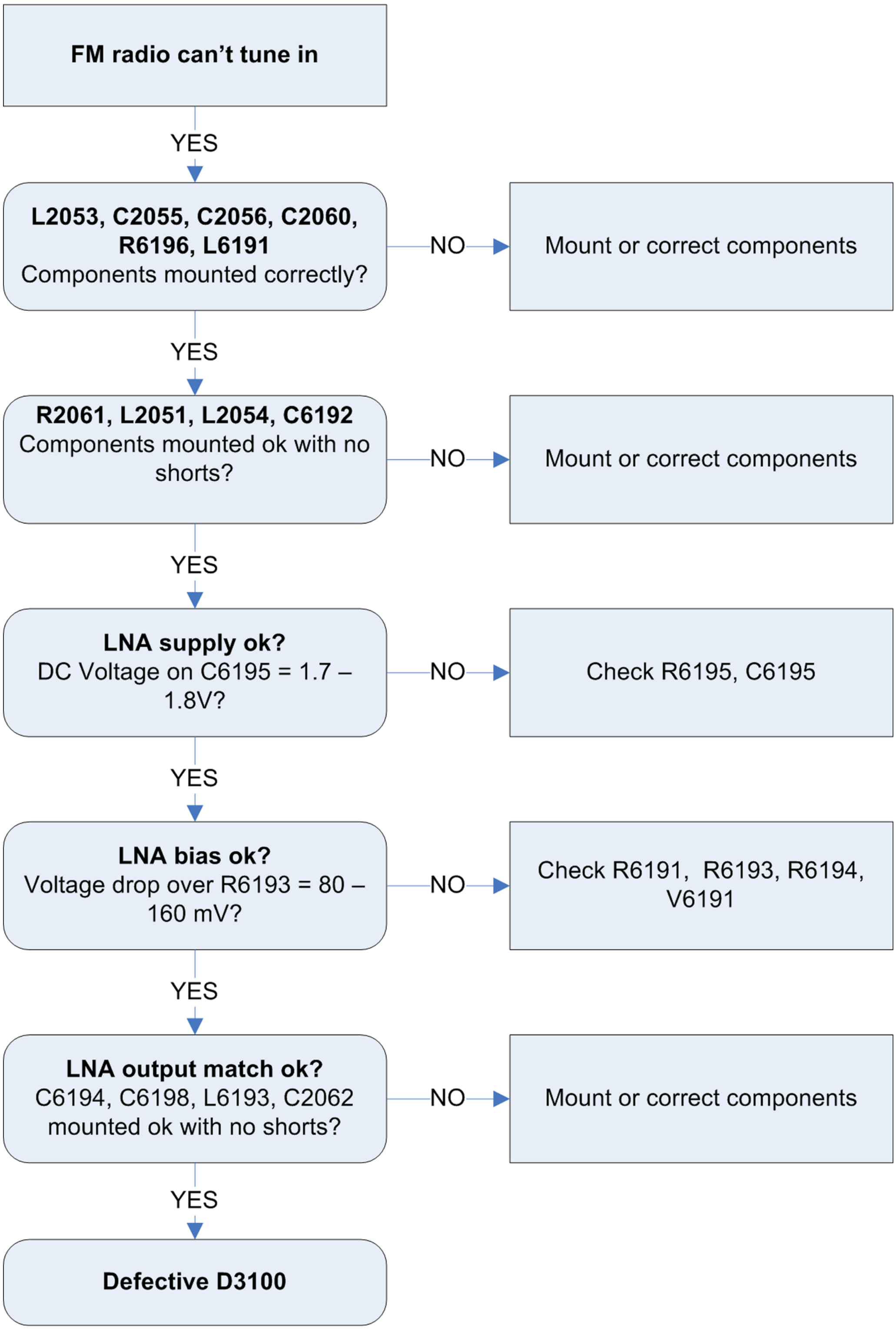
FM radio troubleshooting

FM radio troubleshooting

Context

FM radio problems can fall into two categories; not possible to tune into a station when headset cable is inserted, or it can tune in on a station (Station ID and valid signal strength indicated in display) but there is no audio. In the latter case please refer to "IHF speaker troubleshooting" or "Headset speaker troubleshooting" for trouble shooting the downlink audio path and headset detection function. It is assumed that live FM stations with sufficient signal strength are available on the point of service, and that a dedicated FM signal generator is not used during troubleshooting.

Troubleshooting flow



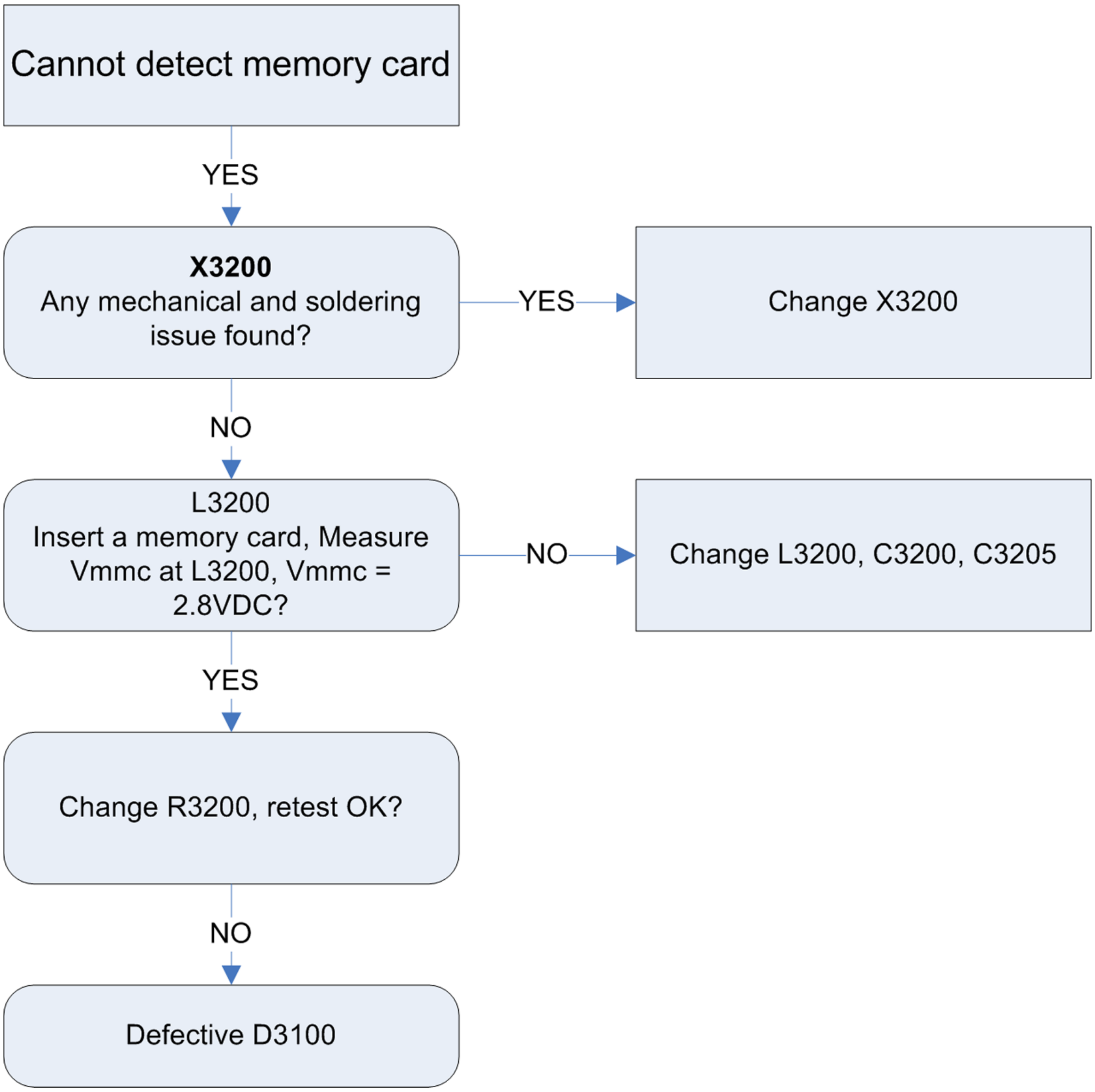
Memory card troubleshooting

Cannot detect memory card

Context

Quantum support SD/MMC card.

Troubleshooting flow



Baseband manual tuning guide

Certificate restoring BB5

Context

This procedure is performed when the Combo Memory is replaced.

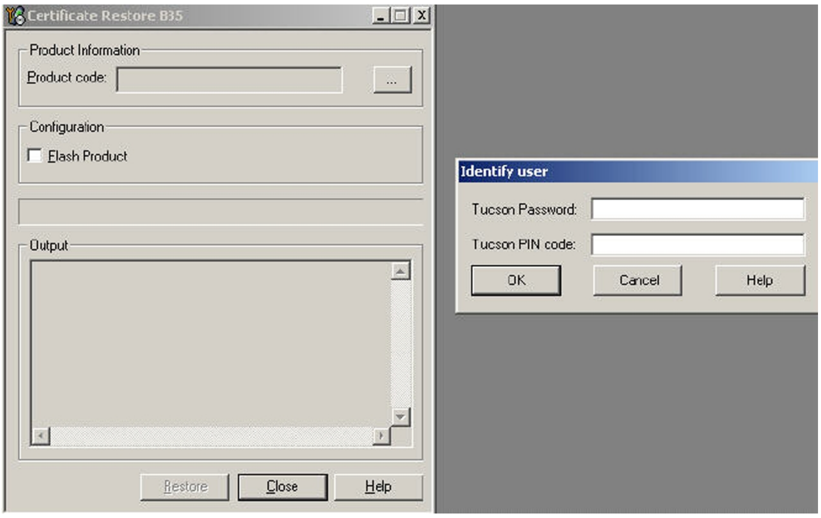
Hardware and Software Setup:

- Latest Phoenix Service Software supporting phone model
- Latest phone model specific Data Package
- FPS--10 or 21 Flash prommer
- SX-4 Smart Card with Enabled Certificate Restore feature
- Phone model specific Module Jig or Generic Module Jig

Refer to the setup in Service Concept.

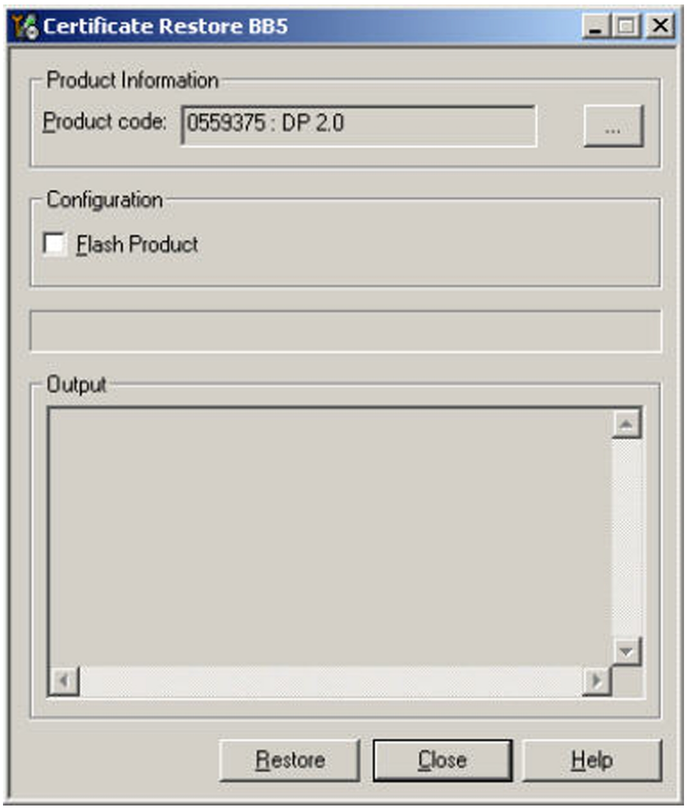
Steps

1. Connect phone and scan product, read phone information to check communication with phone. Select Tools –> Certificate Restore BB5 in the menu.
2. Provide Tucson Password and PIN code. Please note that characters are case sensitive.



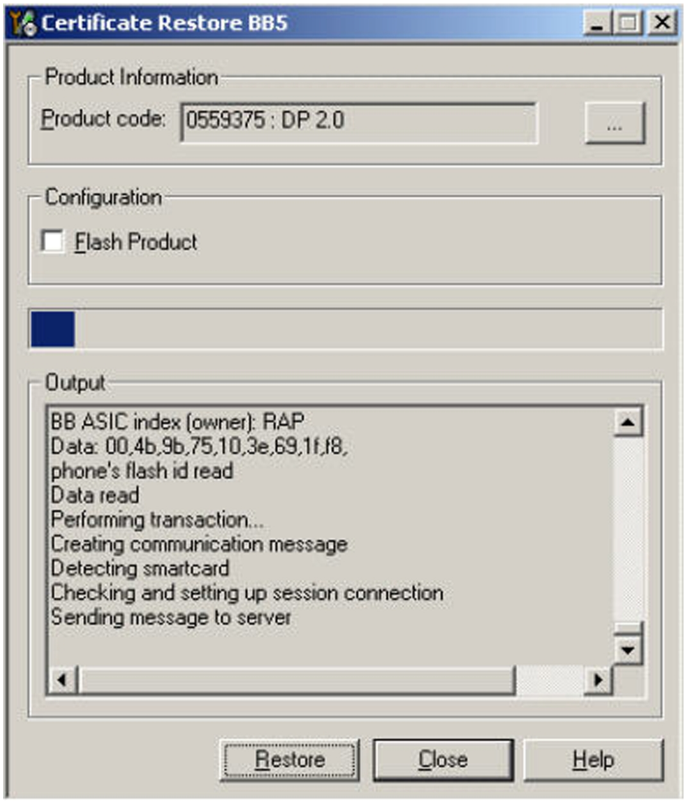
3. Select OK, Phoenix will read product information from phone.
4. Product code shown on the UI does not matter, because during restoring it will be replaced by the product code which is the latest one stored in Nokia system.

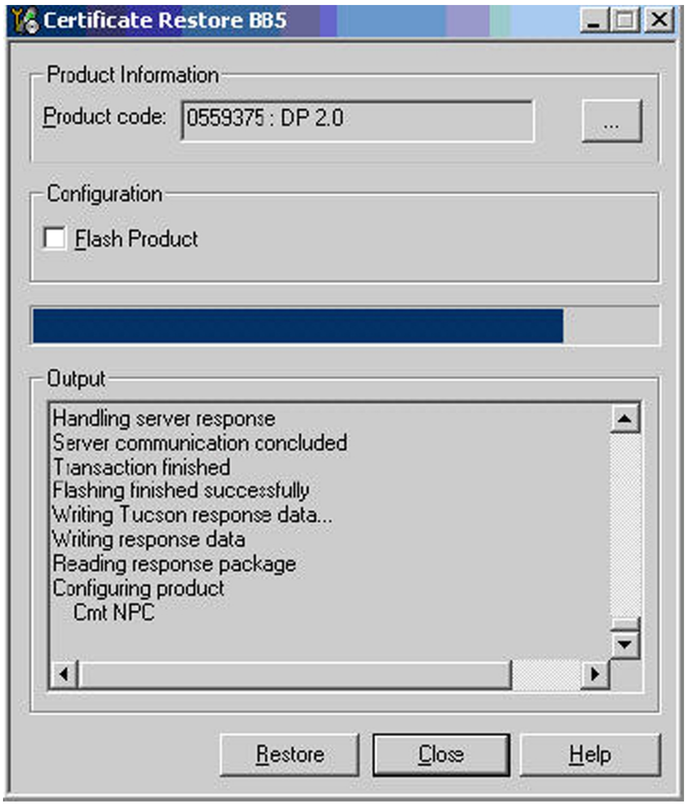
5. It is recommended to perform “Restore” function without selecting “Flash Product” –– option to avoid possible SW downgrade which causes the phone to die.

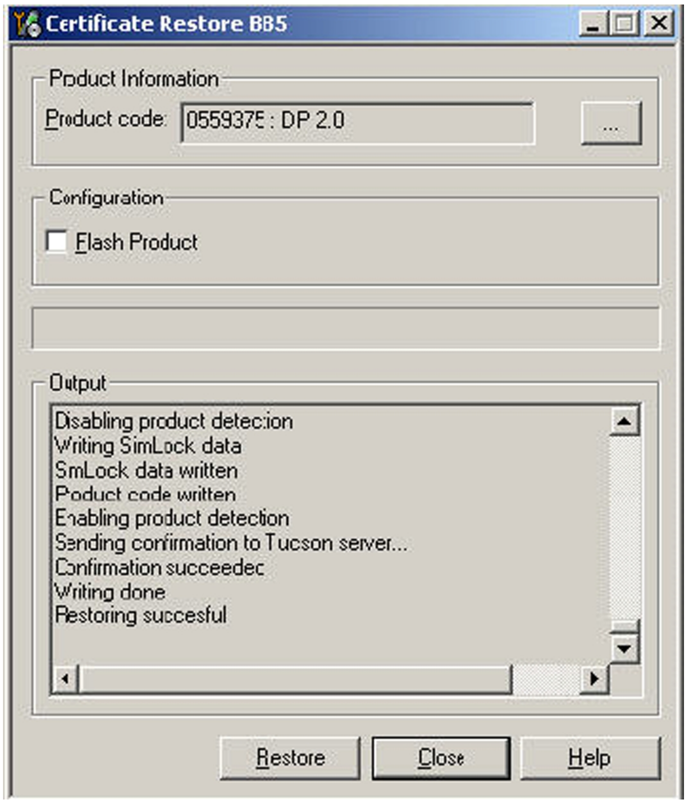


6. Information from phone and Smart Card are read and connection to Tucson server is established.
7. Information from Nokia system is retrieved and programmed in the phone.

8. After programming confirmation about successful event is sent to Nokia system.







Next actions

After a successful rewrite, you must retune the phone completely. (RF and BB)

Energy management calibration

Context

Energy Management calibration is performed to calibrate the settings of the AD converters in several channels to get an accurate AD conversion result.

Hardware and Software Setup:

- Latest Phoenix Service Software supporting phone model
- Latest phone model specific Data Package
- FPS--10 or 21 Flash prommer
- Supply 12V DC from an external power supply to CU-4 to power up the phone
- The phone must be connected to a CU-4 unit with a product-specific Module Jig or generic module jig.

Refer to the setup in Service Concept.

Steps

1. Connect CU-4 with Module Jig, and place the phone module to the Module Jig -> Mode Switch on Flashing + EM CALIB.
2. Start Phoenix service software.
3. Choose File -> Scan Product.
4. Choose Tuning -> Energy Management.
5. To show the current values in the phone memory, click Read.
6. Click Tune & Calculate.

7. The new calibration values are shown in the calculated column. If the new calibration values seem to be acceptable click Write to store the new calibration values to the phone permanent memory.
8. Click Read, and confirm that the new calibration values are stored in the phone memory correctly.
9. End the procedure and close the Energy Management window.

4 — RF Troubleshooting

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Table of Contents

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List of Figures

Introduction to RF Troubleshooting

For the RF troubleshooting, generally 2 types of measurements are used: RF measurements and LF measurements.

RF measurements are done with a spectrum analyzer (or spectrum analyzer alike?) and a high-frequency probe, e.g. Agilent E4440A. Note that the test jig has some losses, which must be taken into consideration when calibrating the test system.

LF (low frequency) and DC measurements should be done with a 10:1 probe and an oscilloscope. The probe used in the following is a 10mW/10pF probe. For the other types of probes the voltages displayed may be slightly different. Always make sure the measurement setup is calibrated when measuring RF parameters on the antenna pad. When re-aligning the phone, the loss in the module repair jig should be included.

Most RF semiconductors are static discharge sensitive, i.e. ESD protection must be added during repair (ground straps and ESD soldering irons). The FEM and the X-GOLD213 are also sensitive to moisture, i.e. these parts must be pre-baked prior to soldering.

Key components are described in this document but there are also a lot of discrete components (resistors, inductors and capacitors) where the troubleshooting is done by checking if soldering of the component is done properly and checking if the component is missing from PWB. Capacitors can be checked for short-circuiting and resistors for value by means of an Ohm meter. However it should be noted that in-circuit measurements should be evaluated carefully.

Non re-workable RF Components

The non-reworkable component for the Quantum is the X-GOLD213 (D3100). All other components are re-workable.

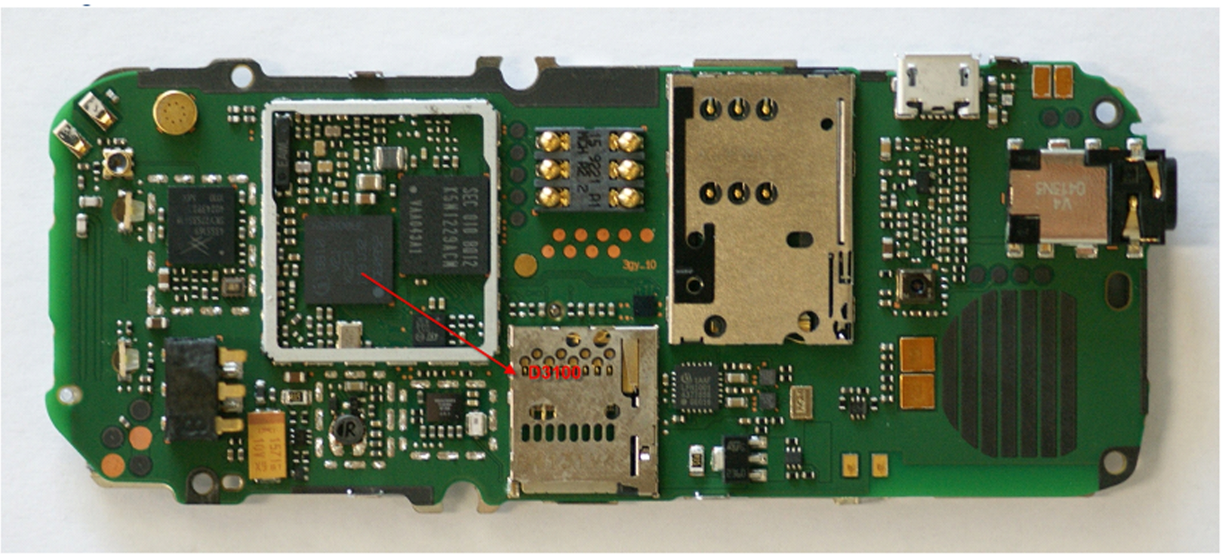


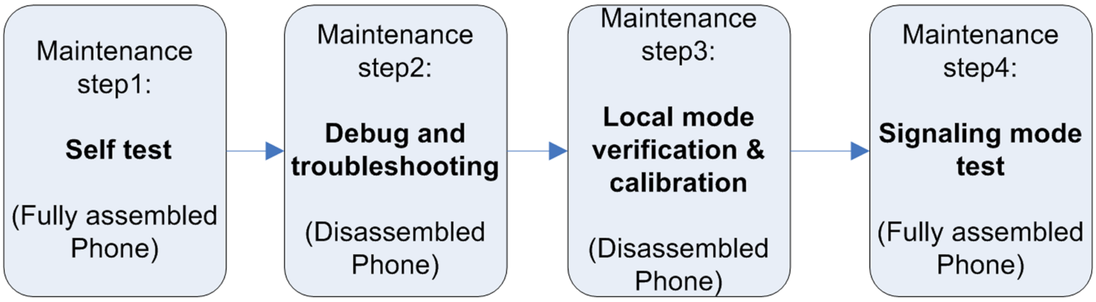
Figure 38 D3100 is the non-reworkable components on PWB

Maintenance Overview

When the phone is received at the service centre, it is fully assembled, and it is the objective to identify the failure area in the phone by doing fast troubleshooting and then locate the failed component(s). Since the X-Gold213 IC is a non-replaceable component, it should be the primary task to identify whether the failure is related to this component or not. In case of failure of the X-GOLD213 the current PCB will be replaced by a new fully mounted PCB. The intention of the troubleshooting procedure is to find the failing component(s). After this a re-tuning + verification of the phone is needed in order to secure passes of all RF parameters and no more failures will be present.

Before sending the phone back to the customers a short verification step in normal mode + live network call will be performed.

The Maintenance steps can be seen in the figure below:



Maintenance step 1

Step 1 is where the phone (MS) is fully assembled, i.e. the RF production connector cannot be used. The purpose is to perform a quick identification of the failure mode using MS self test. The self-test feature will not be able to detect the failed component, but in best case it can detect the failure area/functionality. Note that the self test might not catch all failures.

Purpose of step 1:

- Fast identification of any failures when phone is assembled;
- To identify the area of the failures in order to give the operator (Service maintenance operator) further information where to debug. (Note: Self-test will not be able to specify which component(s) is failing only which functionality is failing.)

Maintenance step 2

Step 2 is where the phone (MS) is disassembled and the RF production connector can be used, i.e. the antenna is not mounted. The purpose of this step is to identify the failing component(s) and replace it. In this step the troubleshooting will be made.

Purpose of step 2:

- Identify the failure when phone is disassembled;
- Troubleshooting in order to find the specific failing component(s) and replace it/them.

Maintenance step 3

The Maintenance Step 3 is the local mode verification step. Note that this can be used for both troubleshooting and verification.

Purpose of step 3:

- In case of the MS self-test performed in Maintenance Step 1 didn't show any errors the verification should identify where the error is located (on functional level);
- In case a component(s) has been replaced after troubleshooting, this step should verify that the phone can pass all RF test after recalibration or:
  a Identify if the replaced components was the component(s) causing the failure.
  a Detect if other failures are present after replacing.
- To make a final calibration and verification (local mode) to make sure that the phone passes all RF limits and requirements.

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Maintenance step 4

In Maintenance step 4 the phone will be assembled and a short test in signalling mode in order to verify that the assembled phone with full mechanic and antenna can pass finial UI requirements in Normal Mode, i.e. Signalling Mode and if the phone is able to do a voice call.

Purpose of step 4:

- Finial verification step using normal mode of the full assembled phone before sending it back to the customer;
- To verify the phone is working in live network.

Maintenance working flow

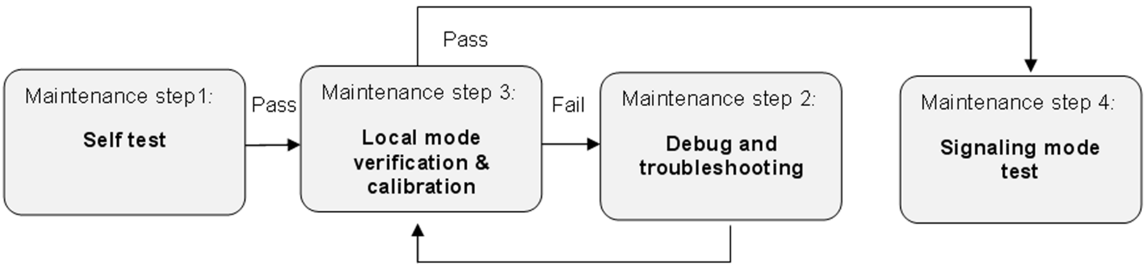
Overview

The Maintenance step 1 is the maintenance step where all self-tests are performed on the fully assembled MS. In some case the Self-tests will detect failure i.e. tell the maintenance operator where to debug. However in other cases the Self-test will not detect any failure however this doesn't mean that a failure is present. In order to locate the area of the failure it's recommended to run verification test (Maintenance step 3) in order to give the Maintenance operator better hint where to trouble shoot.

Below is the different working flow described depending on outcome of the different Self-tests.

Case 1: All Self Tests Passed

Below is the working flow for the case where all Self-test passed illustrated.



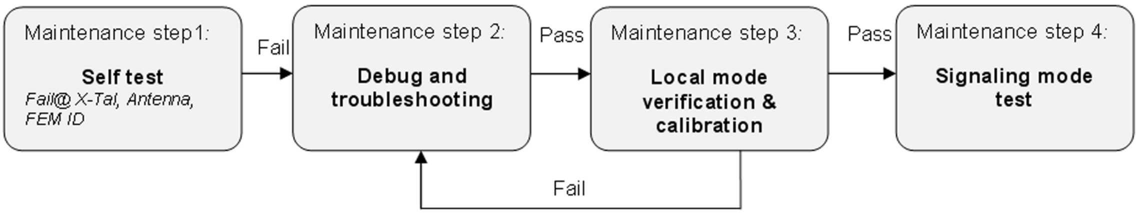
The phone passes all the Self-tests meaning that the Self-Test was not able to detect any failure – however it must be assumed that a failure is present.

In order to locate the area of the failure, the RF verification in Maintenance step 3 need to be executed. The verification step will highlight in which area the failure is present and where to start to troubleshoot. Debugging and troubleshooting are described in the Maintenance Step 2.

After the troubleshooting i.e. finding and replacing the failing components(s) the next step is to re-tune (calibrate) and do RF verification (Maintenance step 3). This is done in order to secure that all failures have been removed and no further failures are present. The MS passes needs to pass all RF related test. Finally the MS is assembled in Maintenance step 4 and verified in normal mode.

Case 2: X-Tal, Antenna detection and FEM ID Self-Test Failed

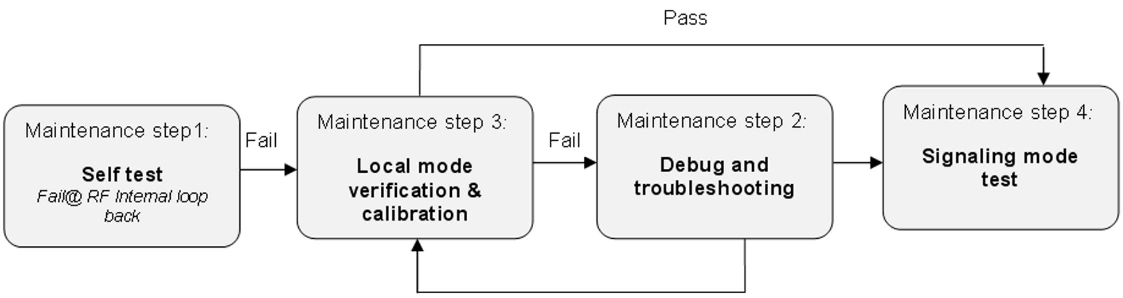
Below is the working flow illustrated for the case where all Self-test fails the X-Tal, Antenna detection or FEM ID Self-test in the Maintenance step.



Debug and troubleshooting should be performed in the area of the Self-test failure i.e. if it is the X-tal self-test that fails then do the X-Tal troubleshooting etc. After the troubleshooting i.e. finding and replacing the failing components(s) the next step is to re-tune (calibrate) and do RF verification (Maintenance step 3). This is done in order to secure that all failures have been removed and no further failures are present. The MS passes needs to pass all RF related test. Finally the MS is assembled in Maintenance step 4 and verified in normal mode.

Case 3: RF Internal Loopback failure

Below is the working flow described in the case where the phone fails at RF internal loop back self-test in the Maintenance step 1.



The Internal Loop Back Self-test is a special test mode where the TX part of the X-GOLD213 is configured to transmit on a RX frequency. This signal is weak amplified in the PA of the FEM and by the antenna switch of the FEM directed to the RX port (not the antenna port as normal operation!) and then looped back to the RX input of the X-GOLD213. The receiver of the X-GOLD213 is then able to measure how much of the transmitted output power is looped back.

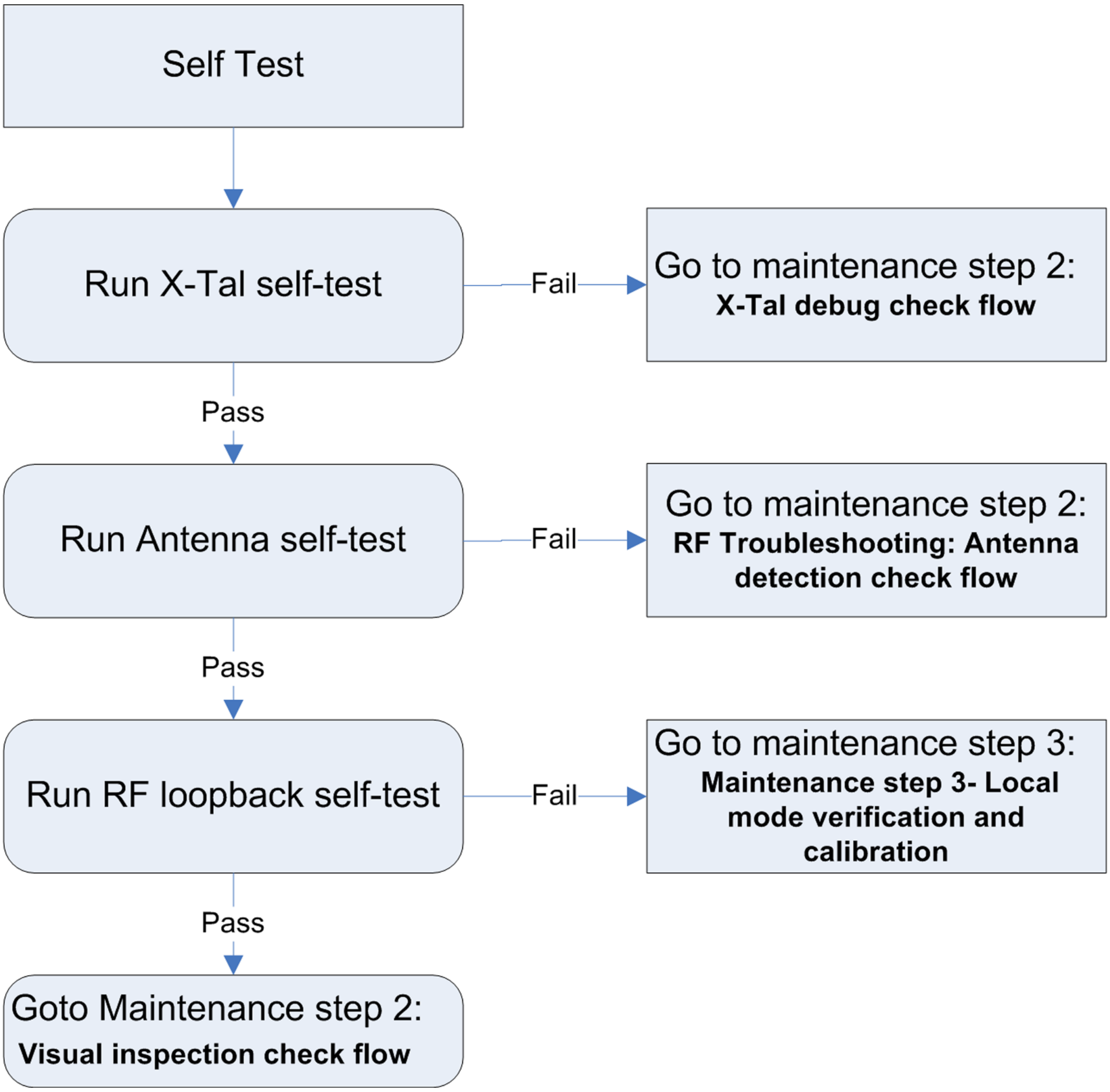
Since a fail in the RF loopback test can be a failure in the TX or RX (LB or HB) and the RF internal loopback self-test is not able to highlight this, it is recommended to do a verification step in the maintenance step 3 – with the only purpose to get the info if the failure is in the TX or RX path.

After troubleshooting i.e. finding and replacing the failing components(s) the next step is to re-tune (calibrate) and do RF verification (Maintenance step 3). This is done in order to secure that all failures have been removed and no further failures are present. The MS passes needs to pass all RF related test. Finally the MS is assembled in Maintenance step 4 and verified in normal mode.

■ Maintenance step 1—Self test

Maintenance step 1 — Self test

Run all self-tests in order to clarify if the Self-Test can detect any failures.



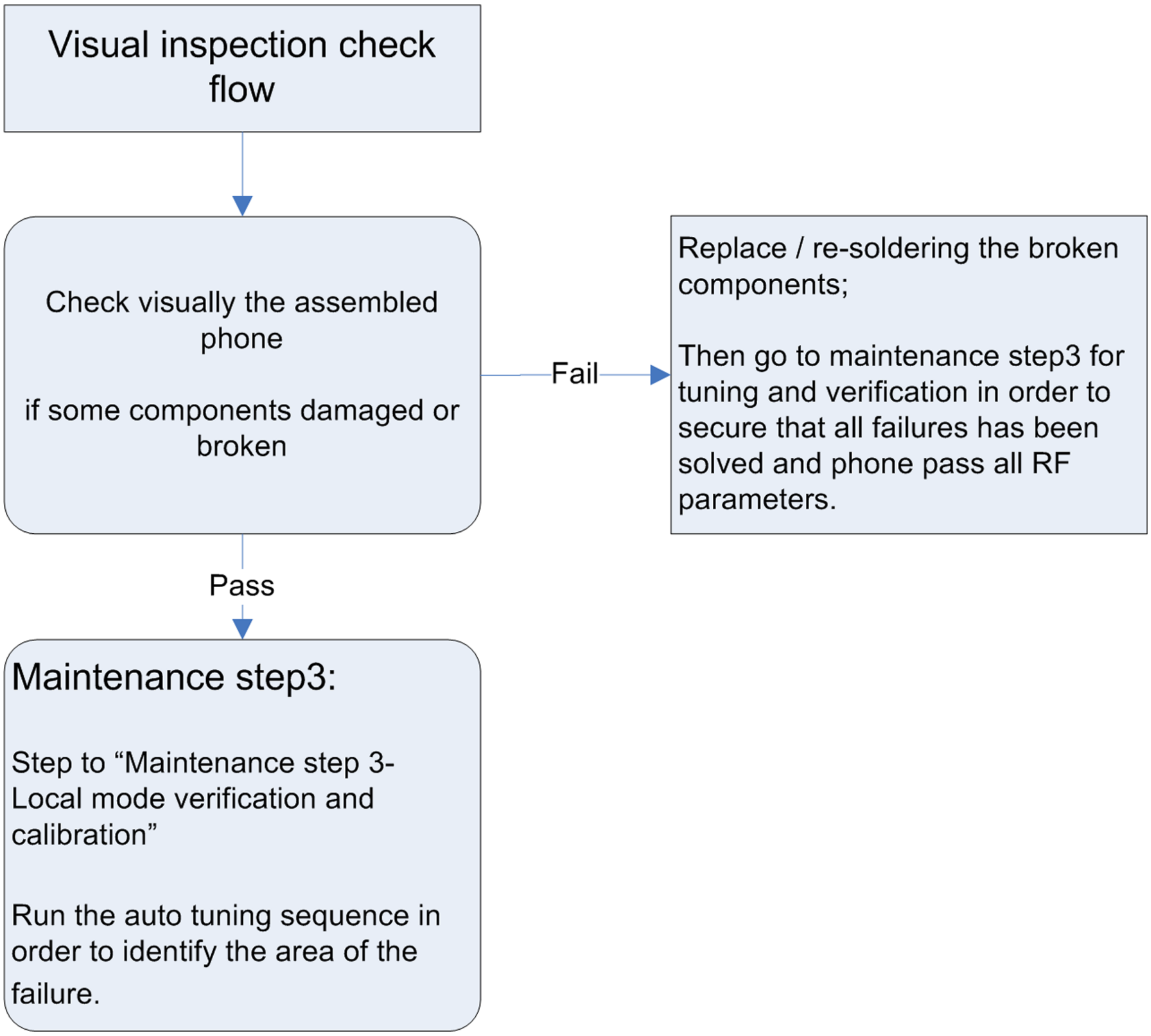
Maintenance step 2 –Debugging and troubleshooting

Maintenance step 2 –Debugging and troubleshooting

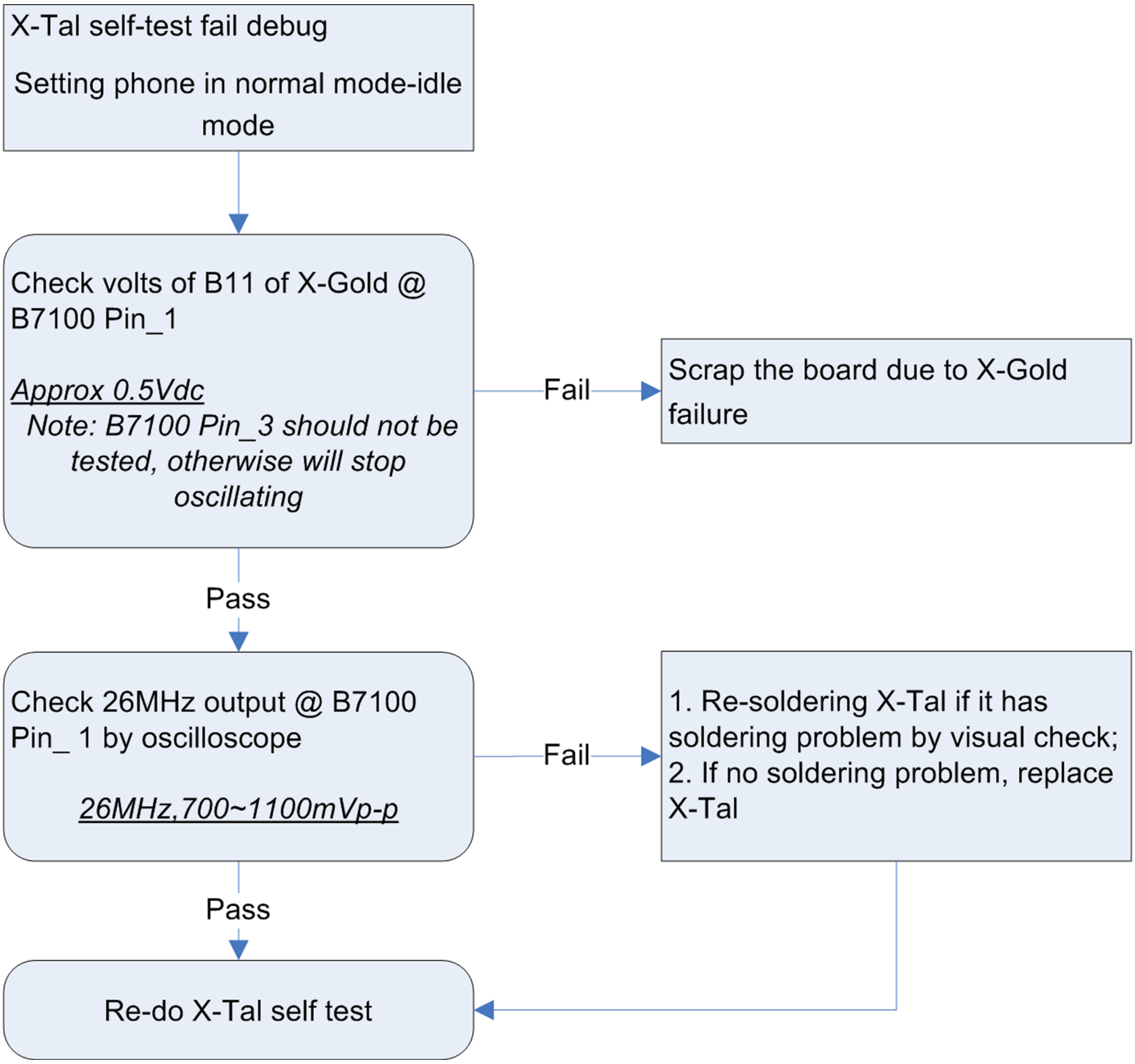
In this stage the phone is disassembled. The goal of this step is to identify the failed component(s) either by visual inspection or by troubleshooting.

Visual inspection check flow

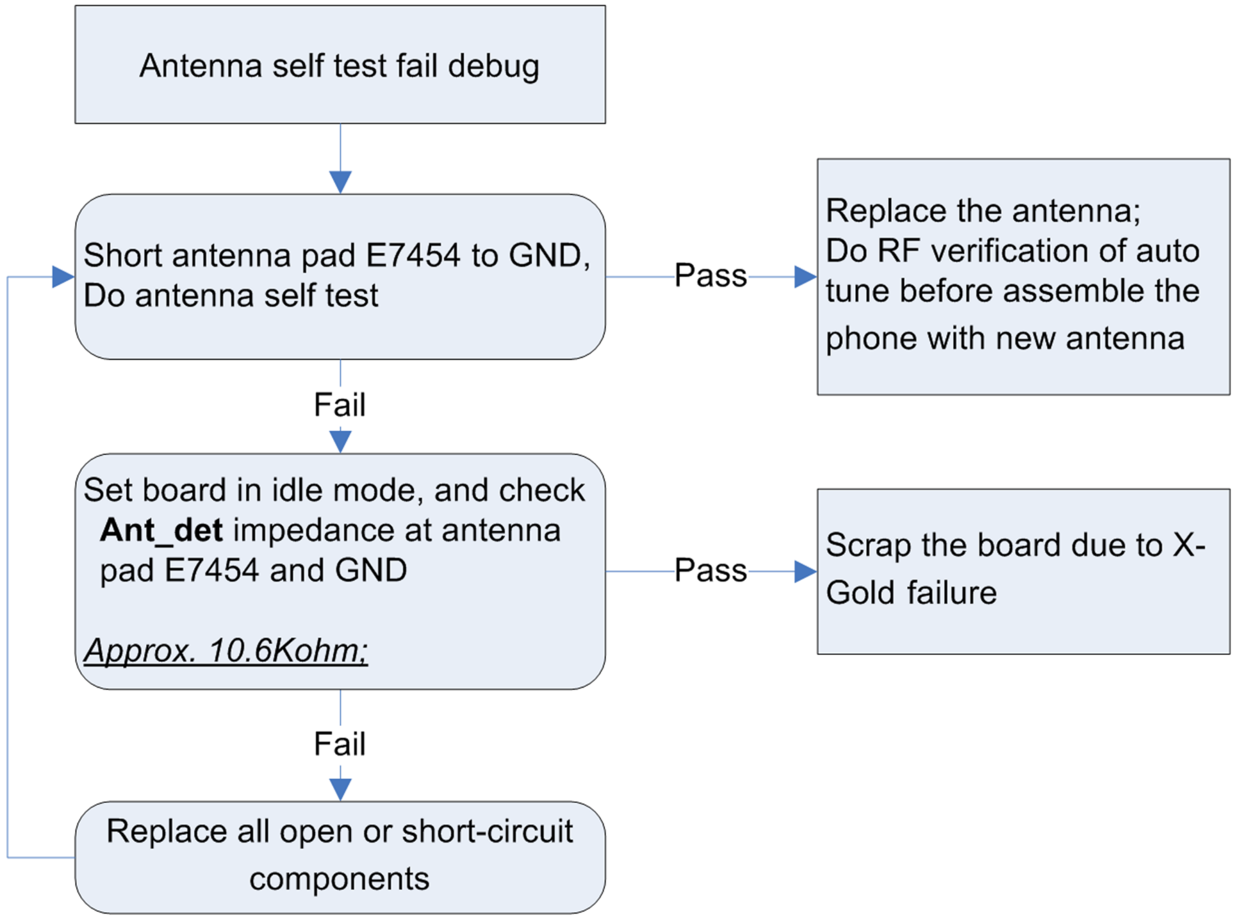
The purpose of the visual inspection is to try by visual to identify the area or component of root cause i.e. locate burned components (mal colure), destroyed components, misplaced components and other visual abnormalities.


Visual inspection check flow
Check visually the assembled phone
if some components damaged or broken
Fail
Replace / re-soldering the broken components;
Then go to maintenance step3 for tuning and verification in order to secure that all failures has been solved and phone pass all RF parameters.
Pass
Maintenance step3:
Step to “Maintenance step 3- Local mode verification and calibration”
Run the auto tuning sequence in order to identify the area of the failure.

RF Troubleshooting: X-Tal debug check flow



RF Troubleshooting: Antenna detection check flow

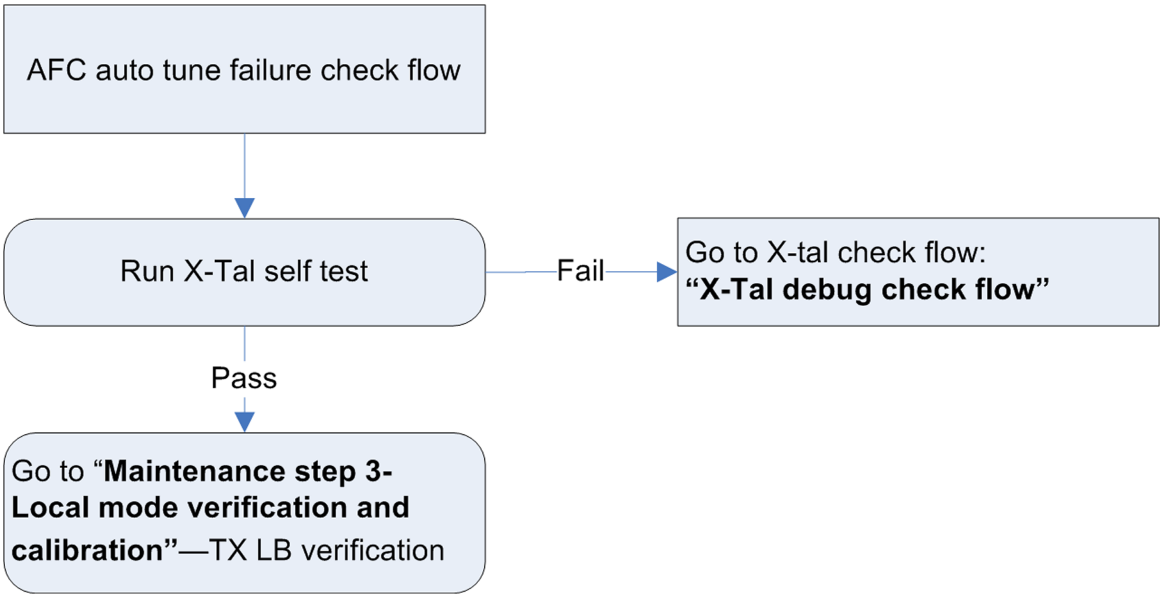


Abbreviation and terms:

Antenna detection circuit used in above check flow is defined as:

Abbreviation	Definition
Ant_det	C7461, R7454, C7462, R7460, C7460, C7459, C7457

RF Troubleshooting: AFC troubleshooting



Receiver troubleshooting

Receiver troubleshooting overview

If the phone failure identified at maintenance step1&3 is indicating failure at the receiver, RX troubleshooting must be executed.

Abbreviation and terms:

Specific abbreviations used in RX troubleshooting workflow are described here:

Abbreviation Definition

RXLB_MN C7115, L7100, C7126

RXHB_MN C7114, L7101, C7129

FEM_RxCtl VC1, VC2, VC3,

FEM_RxCtrlRes R7106, R7110, R7113

FEM_RxCtrlCap C7107, C7110, C7132

FEM_BatComp L7707, C7135, C7125, C7117, C7111

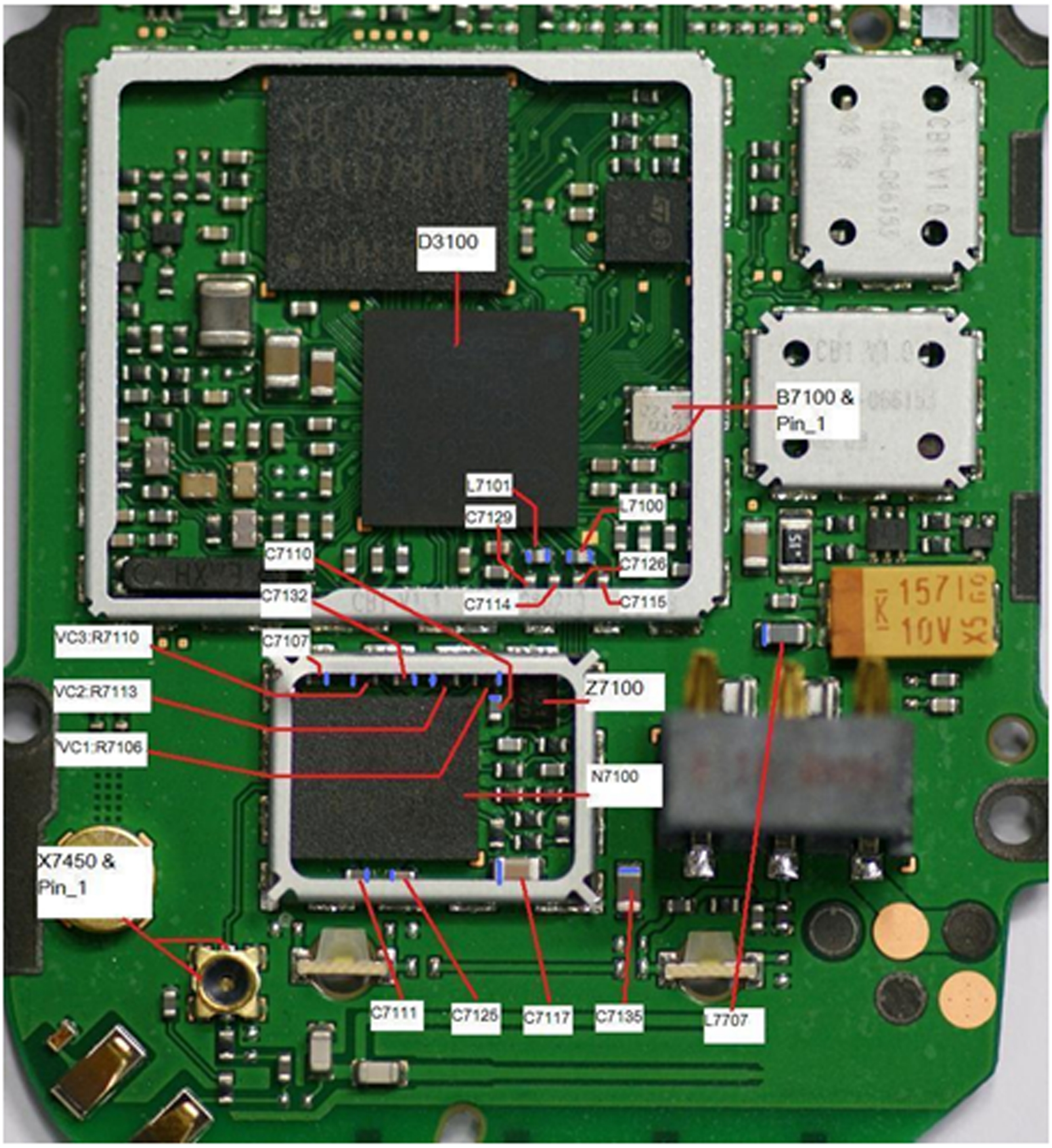


Figure 39 RX checkpoints and component overview (measurement point marked with blue)

RX LB troubleshooting

The test signal from GSM tester must be a continuous signal, as the phone has no means of synchronizing to a GSM burst signal in local mode. To excite the RSSI detector in the same way a modulated GSM signal does, the test signal must either be GMSK modulated (Pseudo-random bit sequence (PRBS)) or an un-modulated CW-signal with 67.7kHz offset from center frequency.


Setting phone in RX GSM850 local mode;
Apply **continuous modulated** RF signal to X7450
Level: -55dBm
Freq: 881.6MHz(GSM850) 942.4MHz(GSM900)
Check X-Gold Pin RX12 & RX12x Volt @ L7100
Pass if approx 870mV Refer to the following figure.
Fail
Check X-Gold power volts:
Refer to the following table.
Fail
Go to Base band trouble shooting
Scrap the board due to X-Gold fail
Pass
Pass
Check signal @ X7450 Pin_1
Passif-55dBm+/-3dB
Fail
1. Resoldering X7450 Pin_1 if it is open by visual check
2.Replace X7450
Pass
1. Resoldering the N7100 and re-check compliance in Maintenance step 3.
2.If non-compliant then replace N7100 with new part and check compliance in Maintenance step 3.
Pass
Check **FEM_RxCtl** @**FEM_RxCtrlRes**
Refer to the above figure.
Fail
Remove **FEM_RxCtrlRes** with the failing voltage, check **FEM_RxCtl** on open circuit towards Cap side
Refer to the following two figures.
Fail
Check if **FEM_RxCtrlCap** is short-circuit to GND, if Yes:
Resoldering/replace the capacitor
if No:
Scrap the board due to X-Gold fail
Pass
Check Z7100 output @C7115-Z7100, and @C7126 -Z7100 ,
Pass if-60dBm+/-3dB
Fail
Check N7100 volts@ L7707- C7135
3.8+/- 0.5V
If No:Replace **FEM_BatComp** if short to GND,
Replace L7707 if L7707 is open
Pass
Resoldering N7100& Z7100 by hot-flow, Check again output @C7115-Z7100, and C7126-Z7100
-60dBm+/-1dB
No
1. Replace N7100
2. Replace Z7100
Pass
Check L7100 both side
Pass if -60dBm+/-3dB
Fail
Resoldering / replace **RXLB_MN** if **RXLB_MN** short-circuit to GND or open
Pass
Check Rx lev and IQ rms vales
Rx lev: 54dBm+/-2dB
IQ rms: 950+/-20 (GSM850)
940+/-20 (GSM900)
Pass
Maintenance step 3

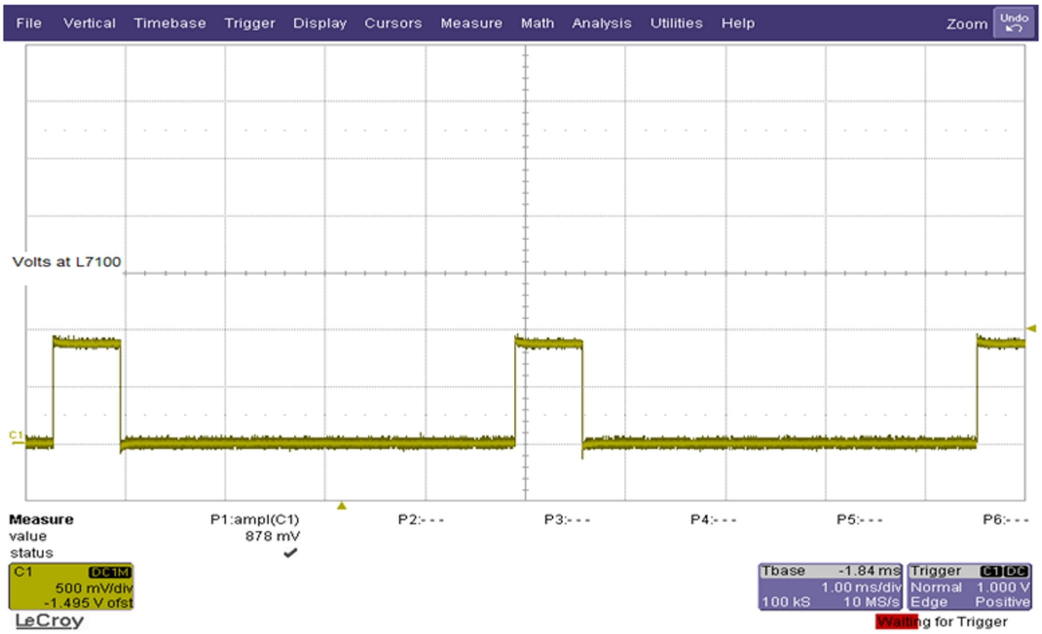


Figure 40 X-Gold RX pin volts @ L7100(LB) / L7101(HB)

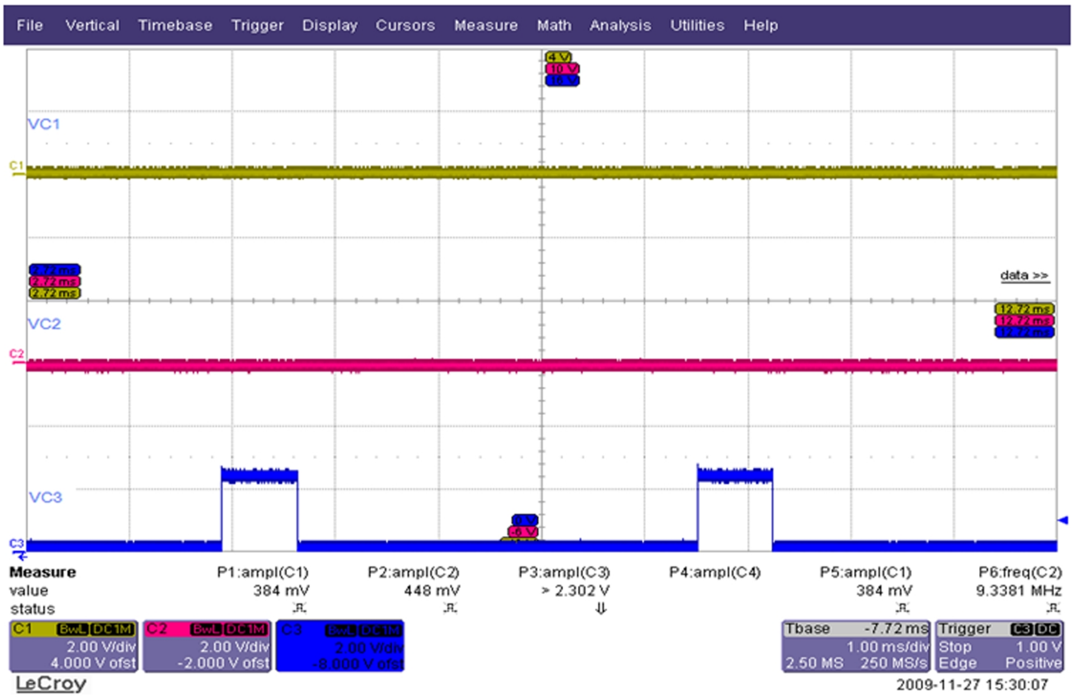


Figure 41 RX LB FEM logic waveform (C1:VC1; C2:VC2; C3:VC3)

Table 1 Power supply voltages for the X-GOLD213 IC RF sub-system

Name	Ball No.	Test point	Function
VBAT	G14	C7134	3.6V typ. Battery voltage, supply voltage of D2B LDO
VDDRF2	G13	C7106	2.5V D2B output voltage, part of RF supply

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Name	Ball No.	Test point	Function
VRF1	H10	C7121	1.8V DCDC output voltage, supply of 1.3V LDOs
VDDTRX	B14	C7124	1.4V Transceiver supply
VDDTDC	B12	C7131	1.3V VDD for Time to Digital Converter of DPLL
VDDMS	H13	C7123	1.3V Mixed signal supply
VDDXO	E11	C7130	1.3V DCXO supply
VDDMMD	A12	NONE	1.3V VDD for Multi Modulus Divider of DPLL

RX HB troubleshooting

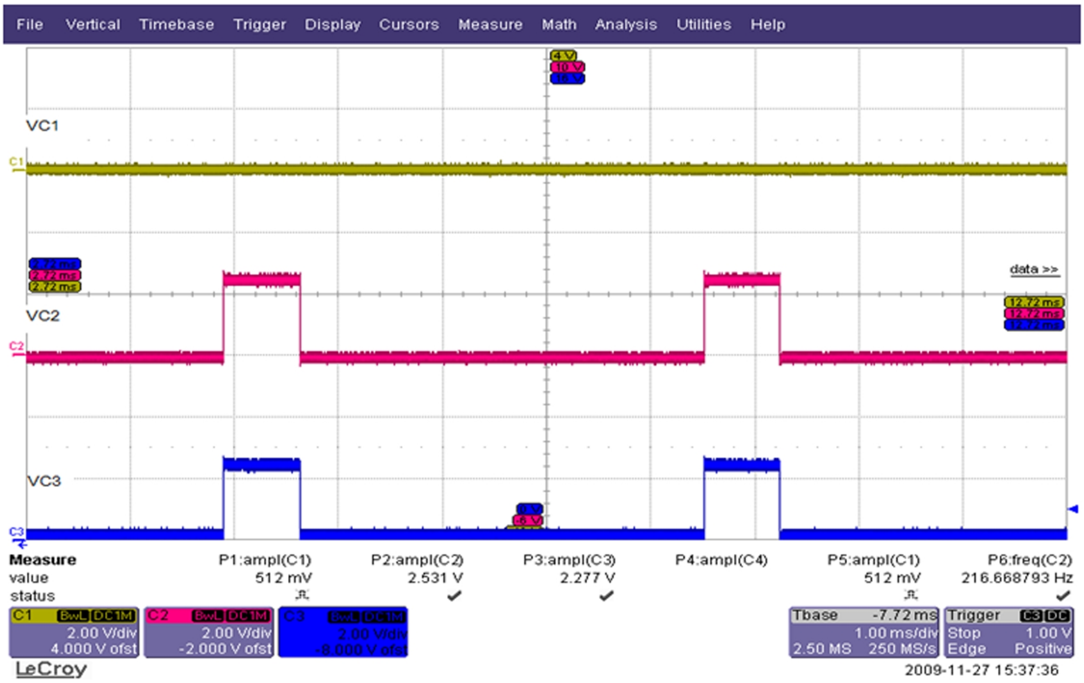


Figure 42 X-Gold RX pin volts @ L7100(LB) / L7101(HB)

Transmitter troubleshooting

Transmitter troubleshooting overview

If the phone failure identified at maintenance step1&3 is transmitter fail, and then the phone should be set to the TX check mode, and then follow the corresponding workflow below for troubleshooting.

Abbreviation and terms:

Specific abbreviations used in TX troubleshooting workflow are described here:

Abbreviation Definition

TXLB_PI_ATT R7107, R7112, R7105

TXHB_PI_ATT R7104, R7108, R7103

TXLB_H4FILTER C7108, C7120, L7504

TXHB_H2FILTER C7109, C7101, L7106

FEM_TxCtl VC1,VC2, VC3, PAEN

FEM_TxCtrlRes R7106, R7110, R7113,R7100

FEM_TxCtrlCap C7105, C7107, C7110,C7132

FEM_BatComp L7707, C7135, C7125, C7117, C7111

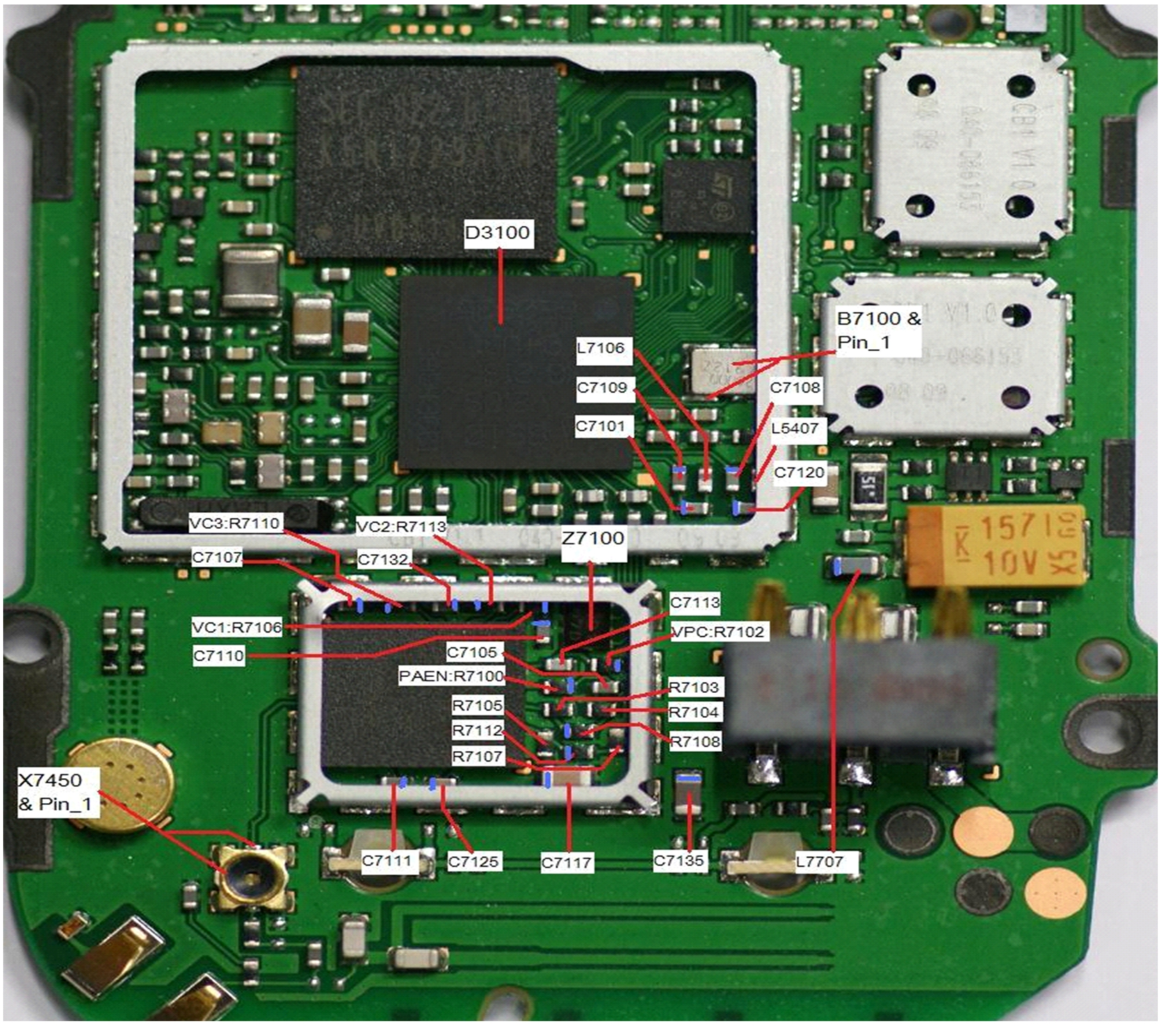
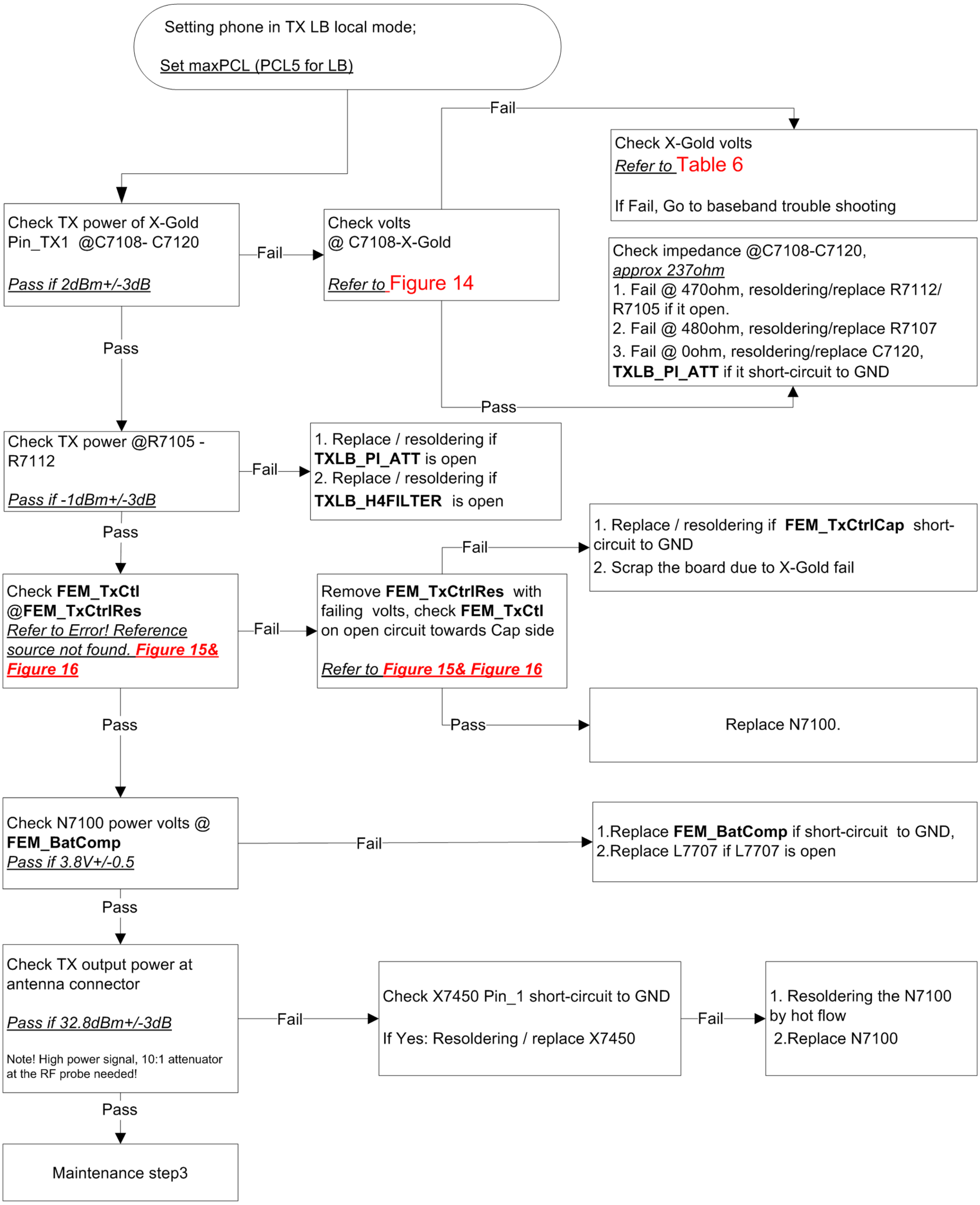


Figure 43 TX checkpoints and component overview (measurement point marked with blue)

TX LB troubleshooting



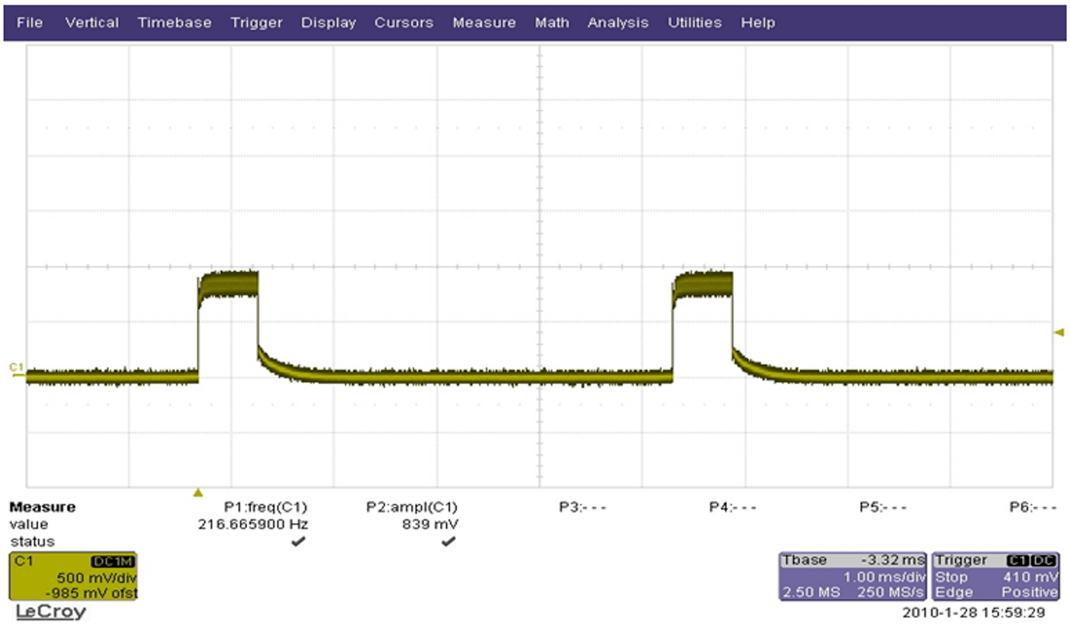


Figure 44 X-Gold TX pin volts @ C7108(LB) /C7109 (HB)

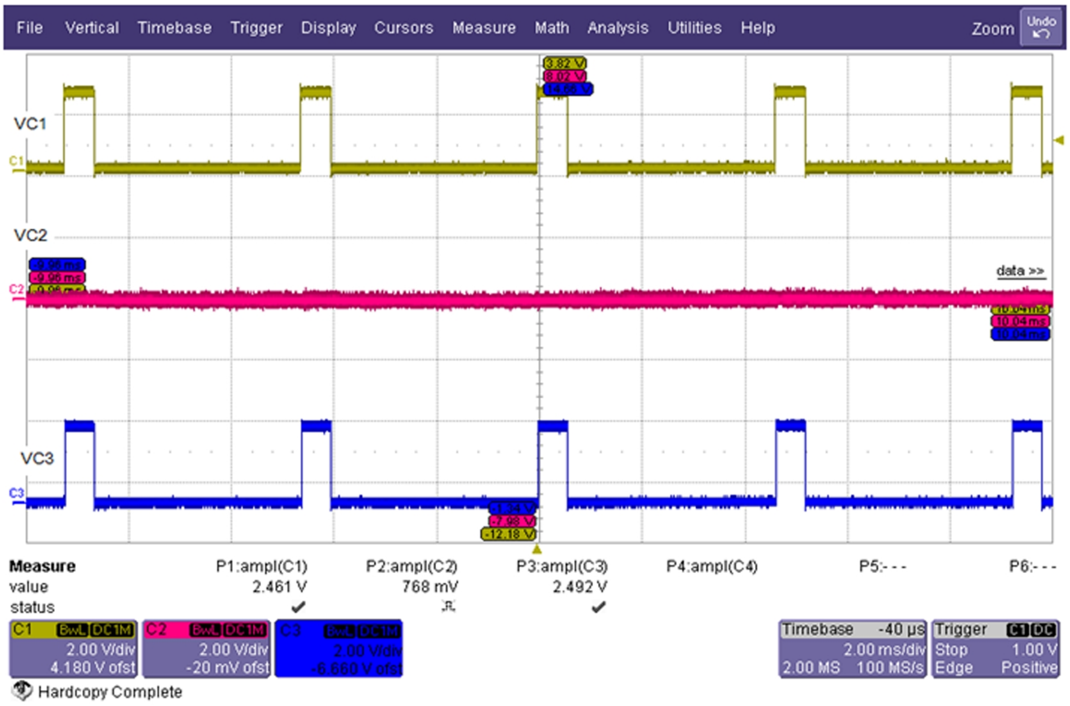


Figure 45 RX LB FEM logic waveform (C1:VC1; C2:VC2; C3:VC3)

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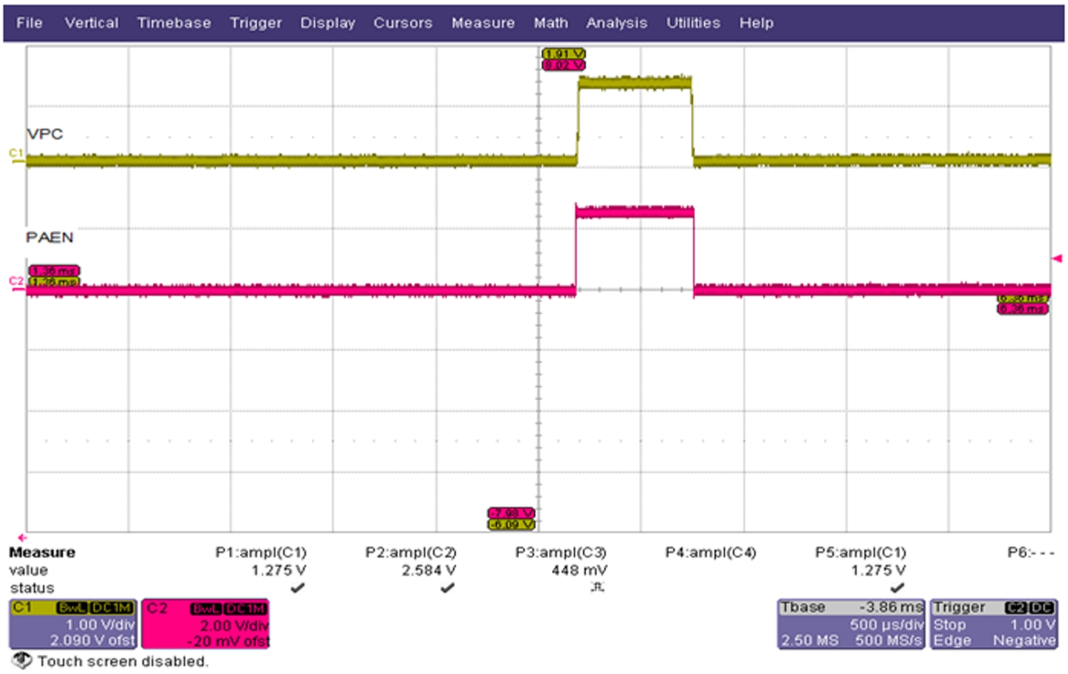
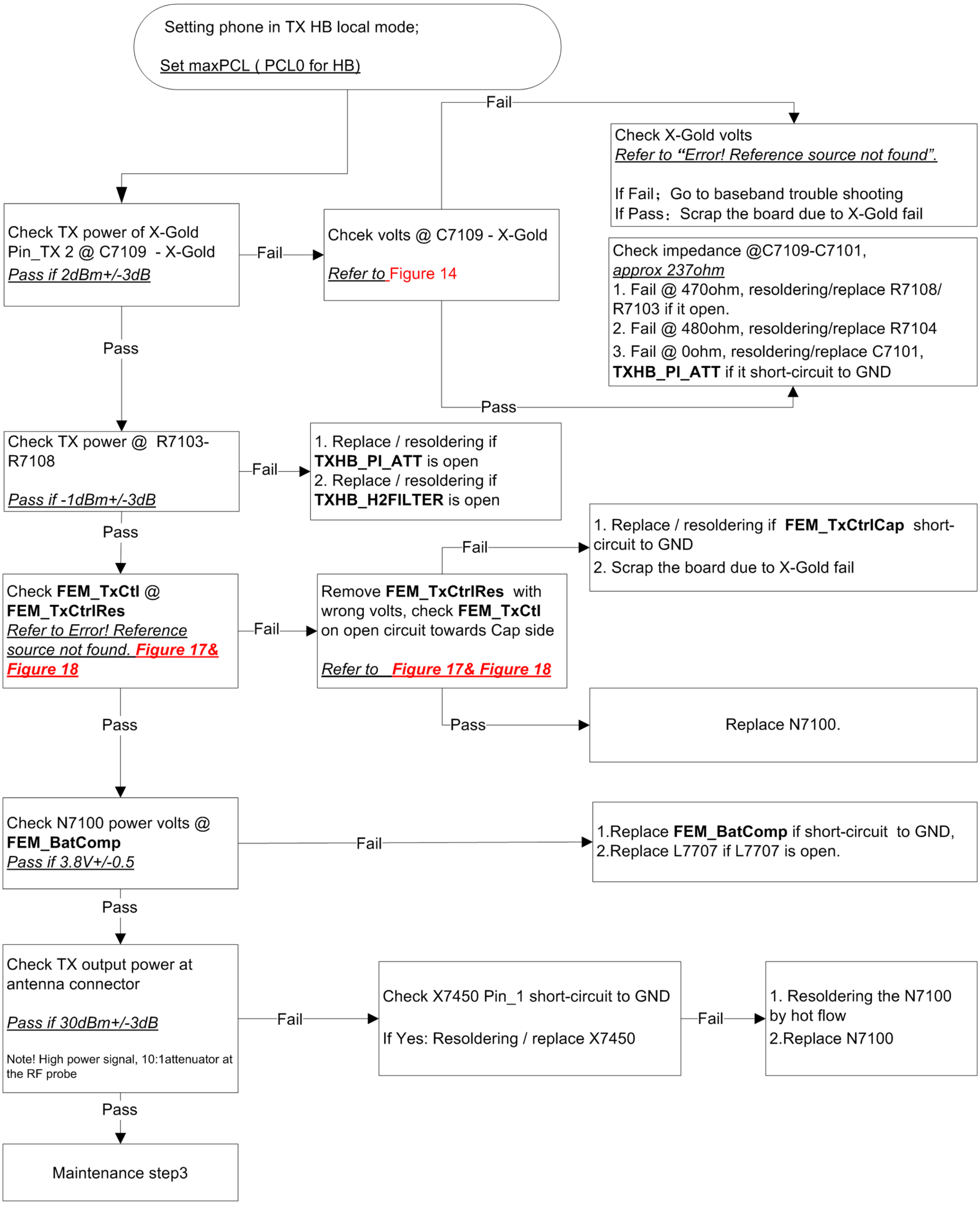


Figure 46 TX LB VPC logic waveform-PCL5 (C1: VPC; C2: PAEN)

TX HB troubleshooting



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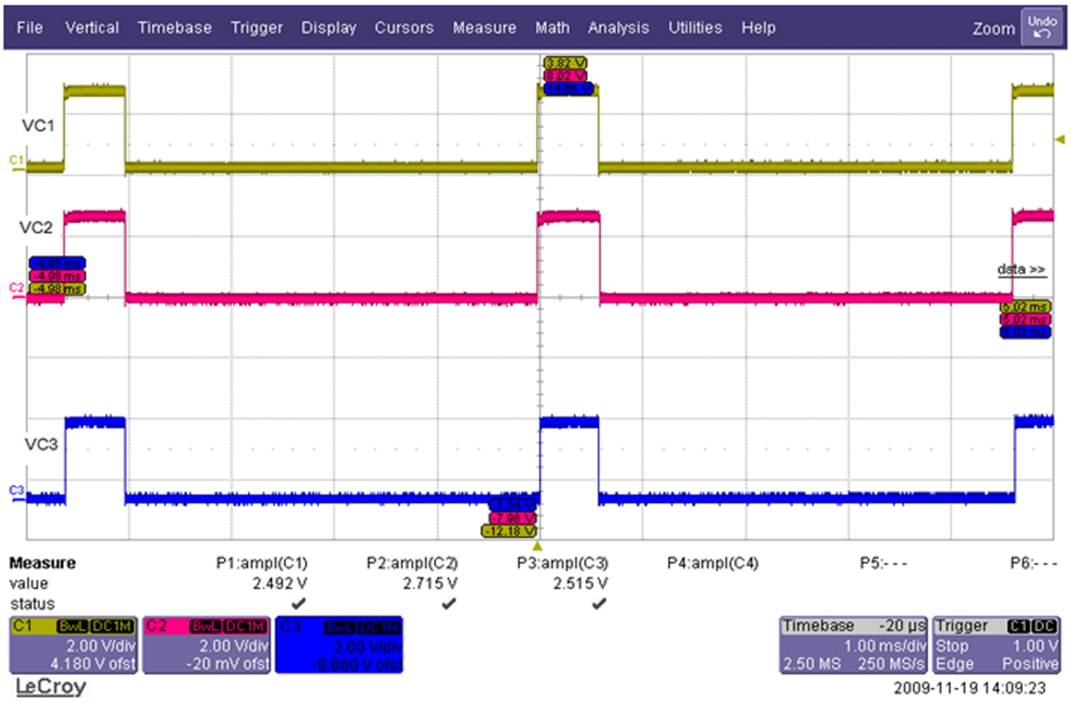


Figure 47 TX HB FEM logic waveform (C1:VC1; C2:VC2; C3:VC3)

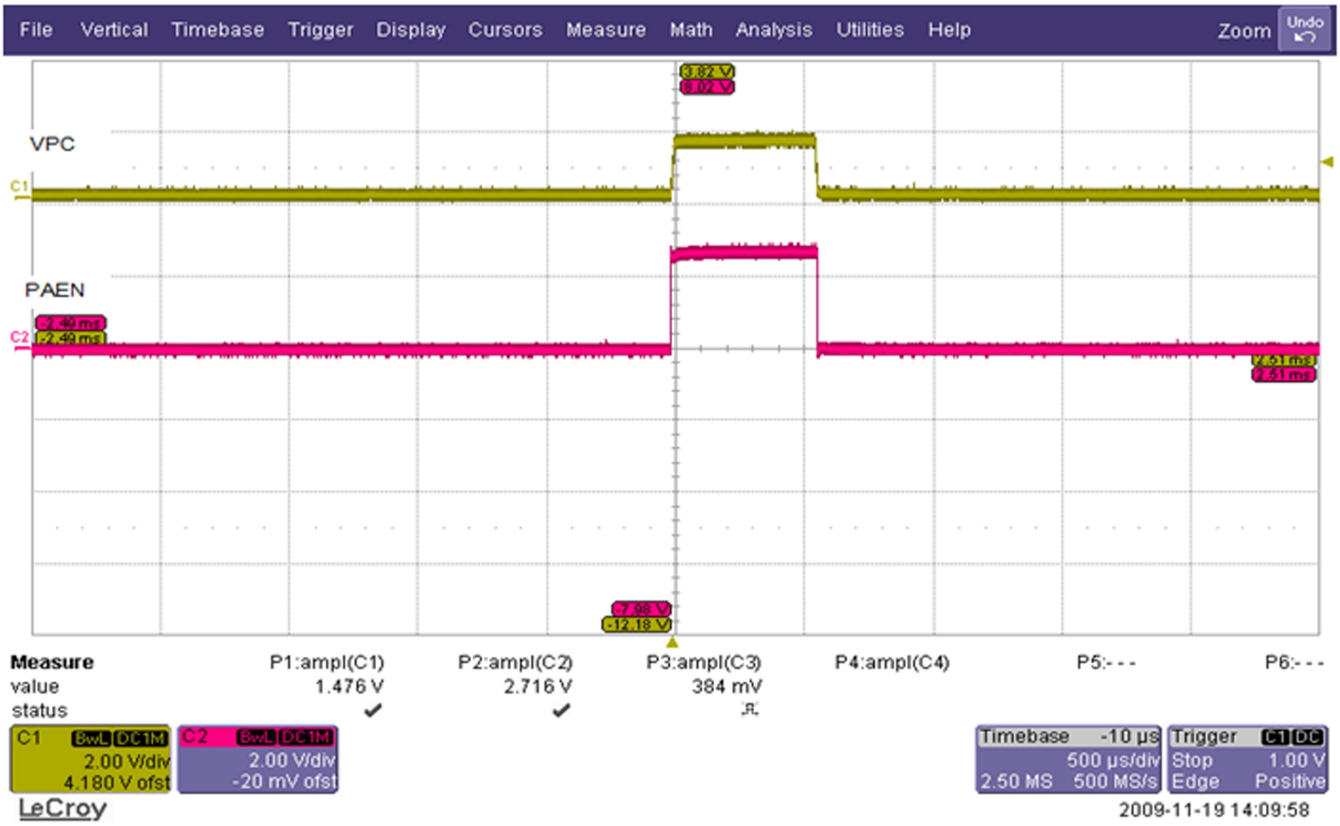
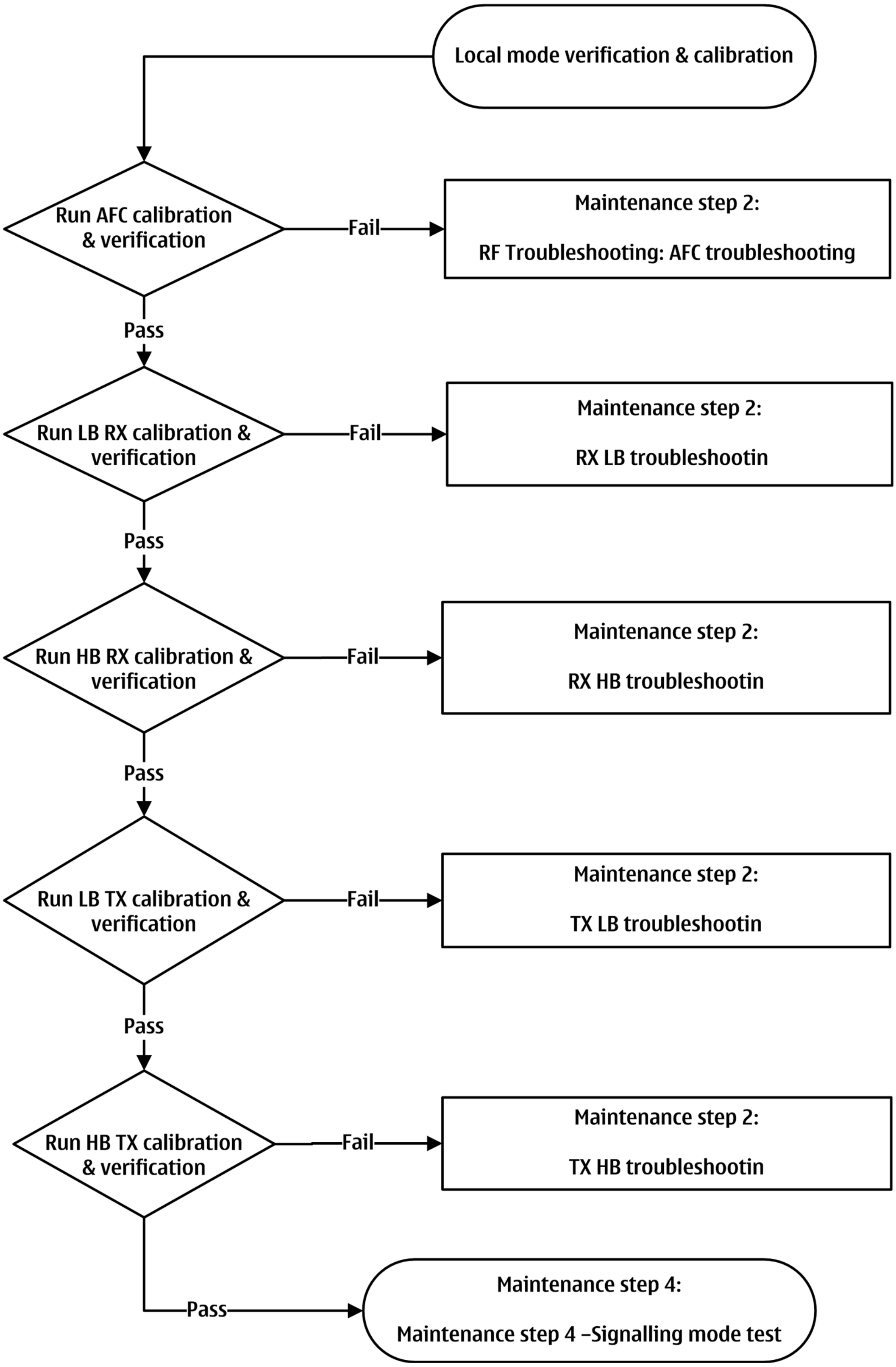


Figure 48 TX HB VPC logic waveform-PCL0 (C1: VPC; C2: PAEN)

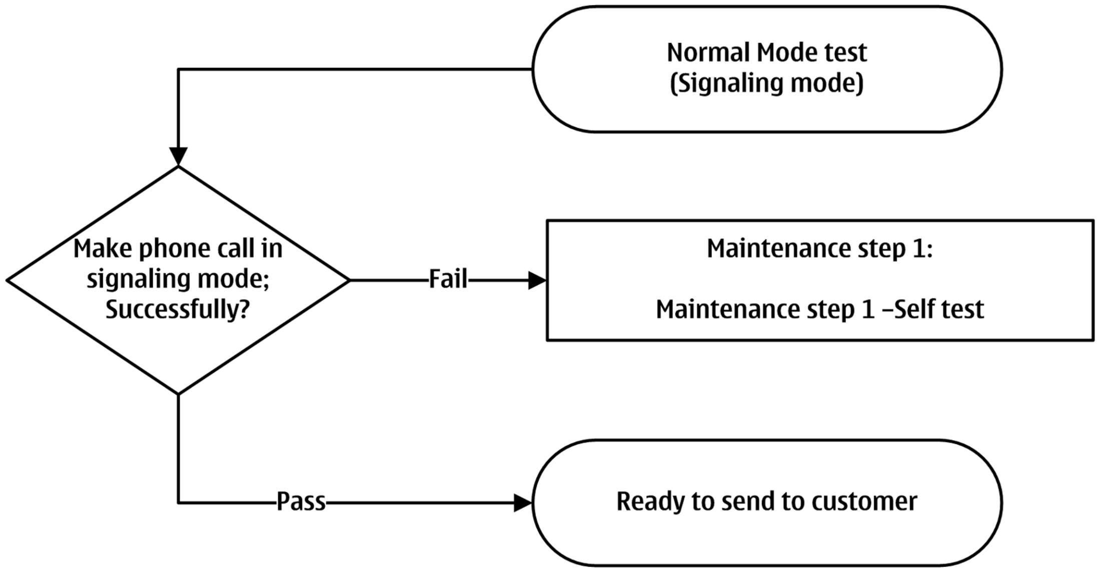
Maintenance step 3- Local mode verification and calibration

Maintenance step 3- local mode verification and calibration



Maintenance step 4 –Signalling mode test

Maintenance step 4 –Signalling mode test



NOKIA CARE SUITE Testing and Tuning Tool

General

General

Care Suite (CS) is multi-protocol service software that supports Nokia TD-SCDMA, CDMA, GSM and WCDMA products. Please see product specific technical bulletins for phone model specific information and instructions.

Important: This document does not claim to be exhaustive. The actual software install or uninstall process may vary from this description depending on the computer hardware used, the software already installed and the entries in the registry.

Close all applications before installing Nokia service software.

Read the information provided by the installation program carefully, it often points out important steps in the installation!

Legal notice

License issues

OpenSSL license:

http://www.openssl.org/source/license.html

Knowledge with Intelligence for Care Support (KICS)

Information and software for all Nokia products is available in Nokia Online / KICS Information Page (https://icknowledge.online.nokia.com). After logging in with a valid user name and password, select the *S&R Documents* category and then *Service Sw* sub category.

If you do not have access to KICS, please go to the site and click on Registration Request.

For each new software version, a description of the changes and modifications is made available in the form of a service bulletin. You will find it in the Service Bulletins category once you select a specific model under the subcategory list.

Installation path

A default installation path is provided (*C:|Program Files|Nokia|Nokia Care Suite|TestingAndTuningTool*).

Preparation

Preparation

Supported OS

- Microsoft Windows XP SP2
- Microsoft Windows 7

Minimum HW requirements

- CPU: Intel or Intel compatible 1 GHz or faster
- RAM: Minimum 1 GB
- Hard Disk: 300 MB available
- Product-specific service cable or service adapter

SW requirements

- Microsoft .NET Framework 2.0
- Microsoft Core XML Services (MSXML 6)
- Care Suite package: Nokia_Care_Suite_Store_<year>_<week>_<build_number>.msi where year, week and build number are available.
- Product-specific data packages from Online / KICS Information Page, or via online access to Nokia Firmware Repository (FiRe).
- GPIB drivers
- NI VISA Runtime (see next chapter for more information)

Other requirements

- As a part of Testing and Tuning Tool installation National Instruments VISA 4.62 Runtime is installed if it is not exists already. The installation package of the VISA is downloaded from internet so online connection is needed. If the workstation does not have online connection, the VISA can be downloaded from Online / KICS Information Page.
- Note! It may happen that GPIB drivers must be reinstall after the VISA Runtime has been installed. This kind of need has been noticed at least with CEC PCI-488 GPIB card.

Download software from online / KICS information page

Before you install the Care Suite Testing and Tuning Tool software and product-specific data packages, download them from Online / KICS Information Page and save them on your computer or a network server in a suitable folder structure.

Turn off User Account Control

Note: This applies to Microsoft Windows 7 users only.

Before you start installation the User Account Control should be turned off. Go to Control Panel -> User accounts -> Turn user account control on /off -> Uncheck UAC box -> click OK.

Installation

Installation

Installing Care Suite 2010.24.0.xxxx or newer

Care Suite Testing and Tuning Tool can be installed if Care Suite 2010.24.0.xxxx or newer exists. If it doesn't, install it by following instructions described in Care Suite User Guide. *Installation package and user guide for Care Suite can be found in Nokia Online / Care Services / KICS Information Page.*

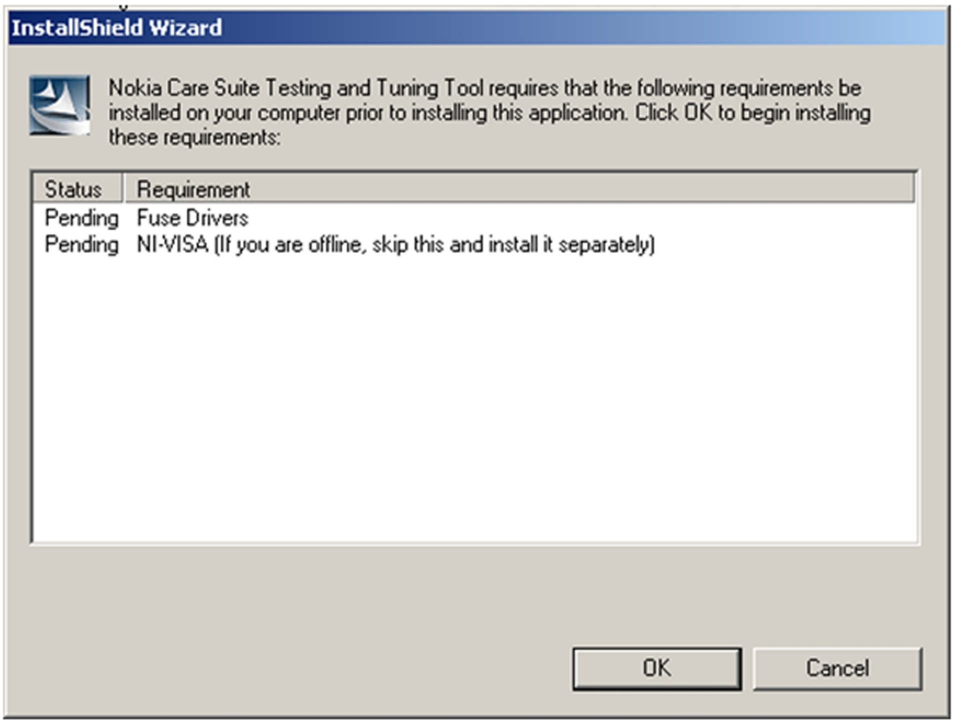
Install testing and tuning tool

You can install Care Suite Testing and Tuning Tool on top of previous versions.

1 Locate file *Testing_and_tuning_tool_<year>_<week>_<build number>.exe* where year, week and build number are variable. Installation package and user guide can be found in Nokia Online / Care Services / KICS Information Page.

2 Double-click *Testing_and_tuning_tool_<year>_<week>_<build number>.exe* and follow the prompts for installation.

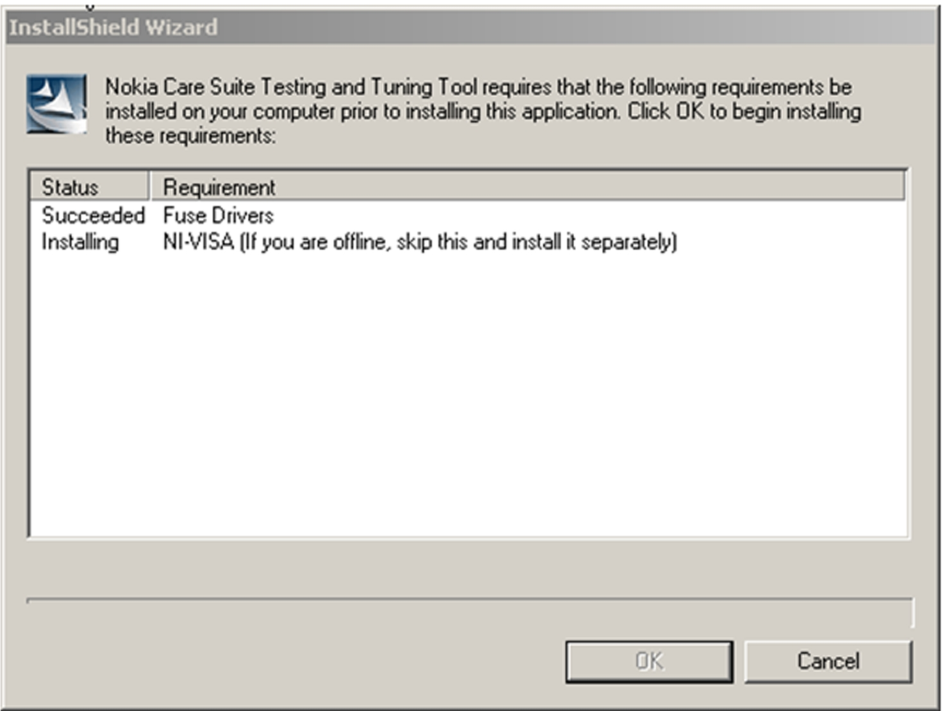
3 If Fuse Drivers (CU-4 drivers) and/or NI VISA hasn't been installed earlier the following dialog appears. Online connection is expected to download NI VISA package. *If your PC has no online connection to internet, cancel the installation and install NI VISA package manually*, please see step 4 below. Otherwise click OK to proceed the installation.



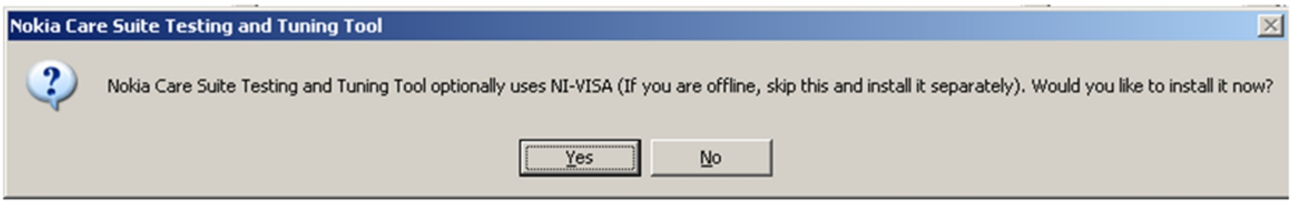
4 If there is no online connection to internet, cancel the installation and install NI VISA manually. Please download executable file (e. g. *NI-VISA462.exe*) from Nokia Online / Care Services / KICS Information Page, double-click *NI-VISA462.exe* and follow the prompts for installation. Please see step 8 below.

5 After you have manually installed NI VISA package, please continue Testing & Tuning Tool installation from step 2 above.

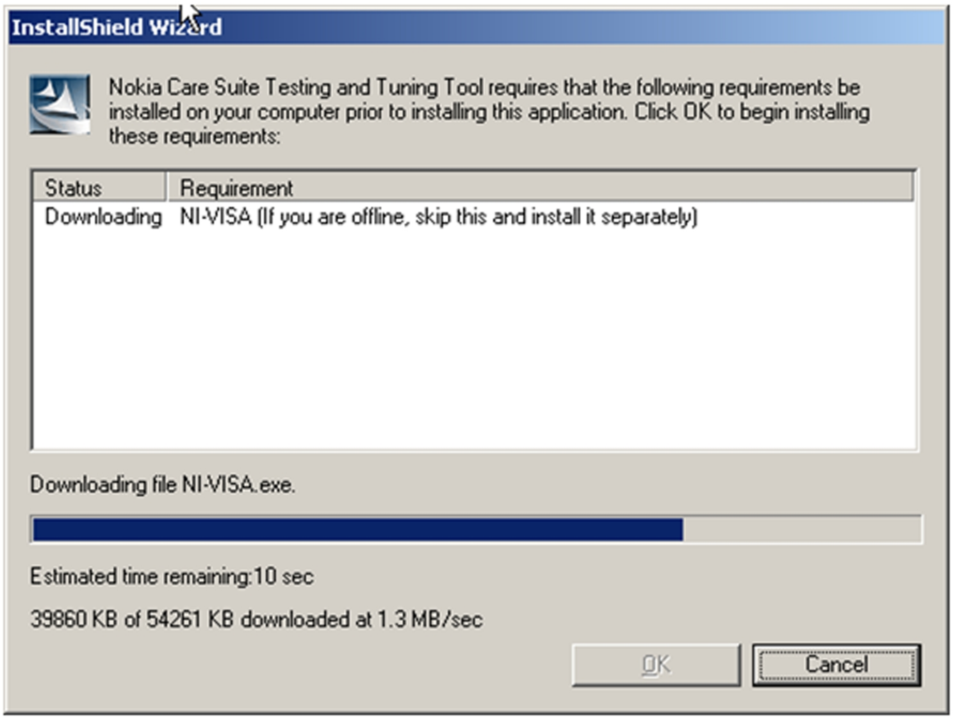
6 Fuse Drivers were successfully installed.



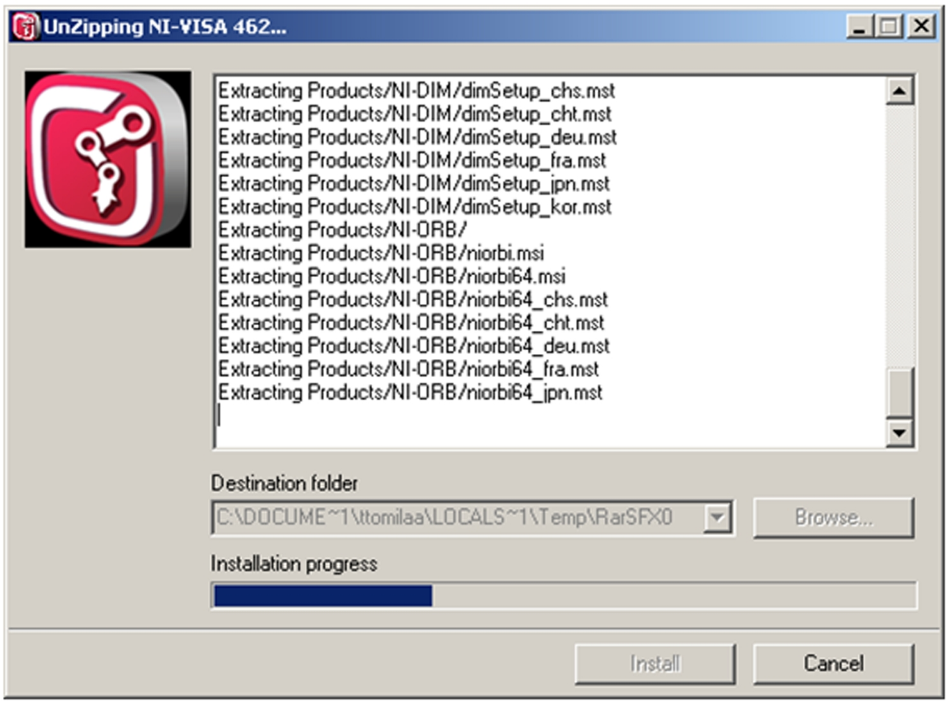
7 Confirm to proceed with NI VISA installation by clicking Yes. No skips the VISA installation and the installation continue in step 11.



8 NI VISA is downloaded.

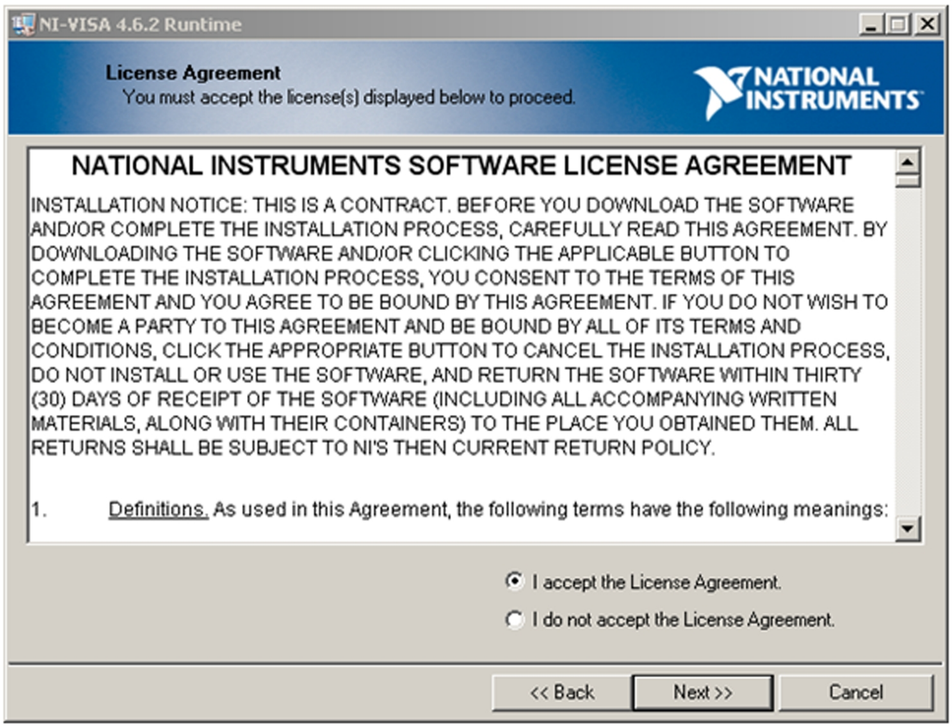


9 Downloaded package is extracted.



10 Press *Next* to start NI-VISA installation.

11 Select "*I accept...*" and click next.



12 NI VISA is being installed.

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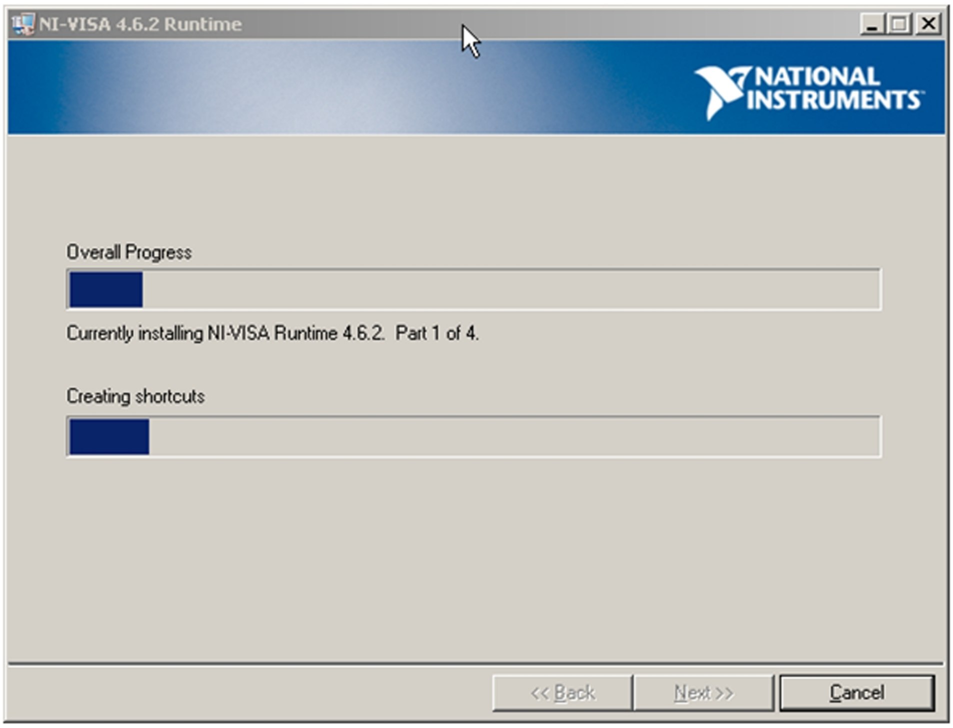
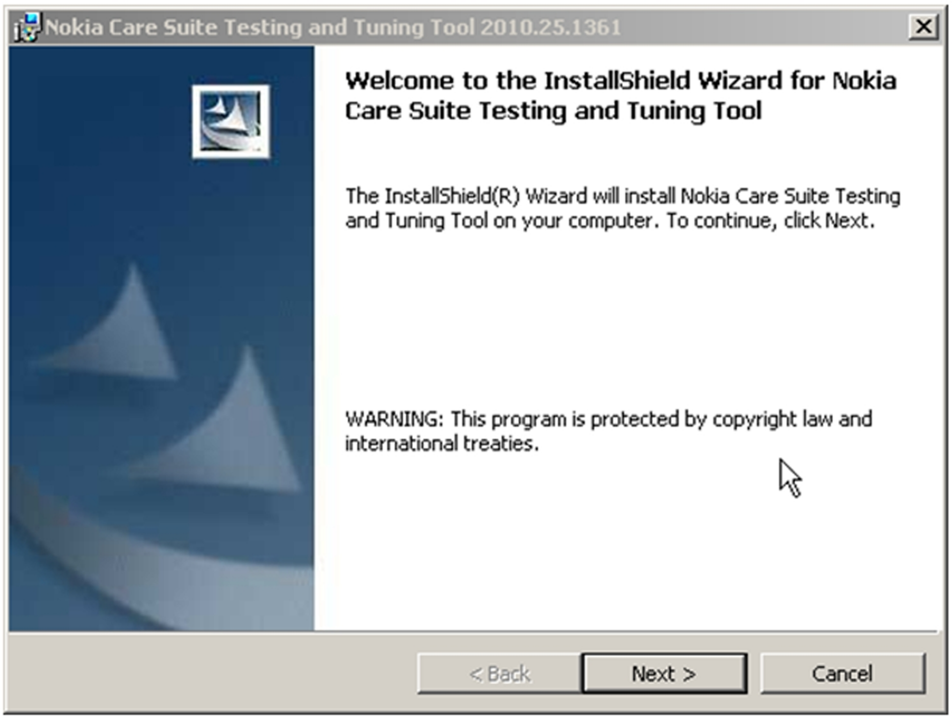
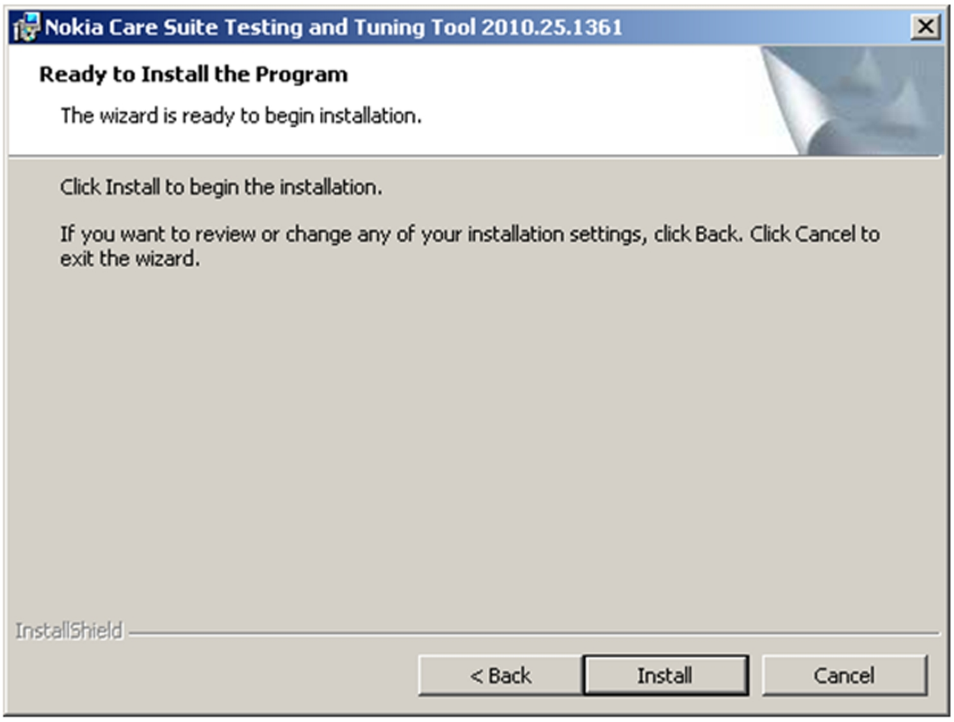


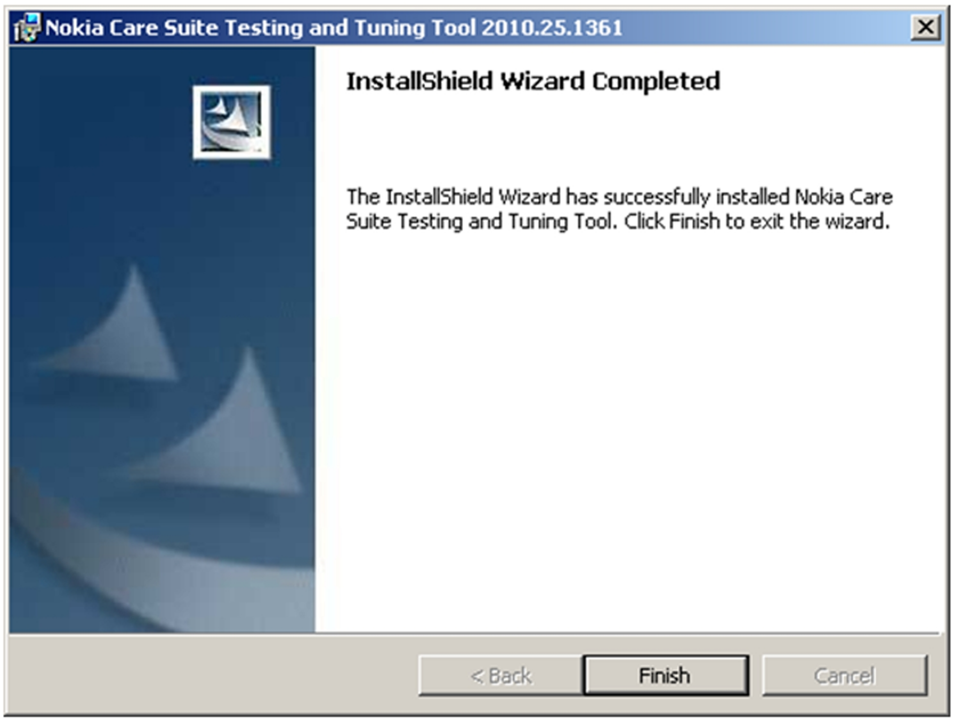
13 Care Suite Testing and Tuning Tool installation starts. Please note that if NI VISA and CU-4 drivers have been installed this is the starting point for the installation. Click *Next* when space requirements computing is done. *If your PC does not have online connection to internet, and you installed NI VISA package manually, please continue manual installation from step 2 above.*



14 Click *Install* to proceed with installation.

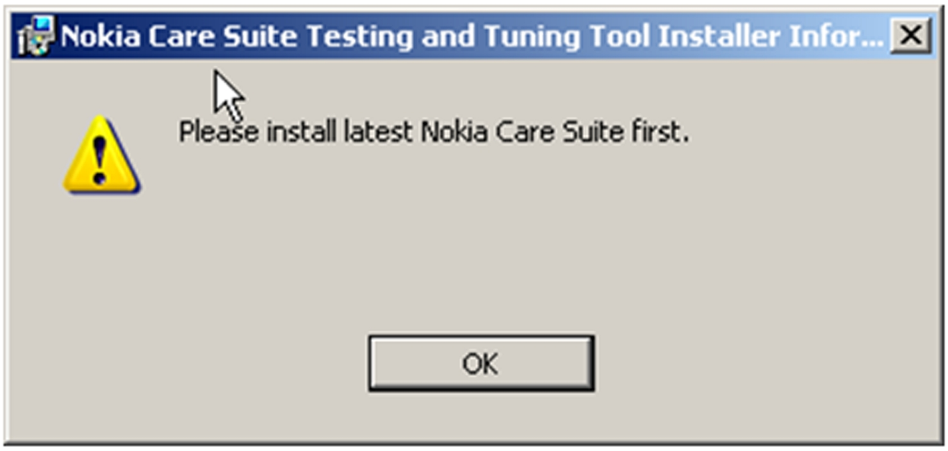


15 Press *Finish* to complete the installation.



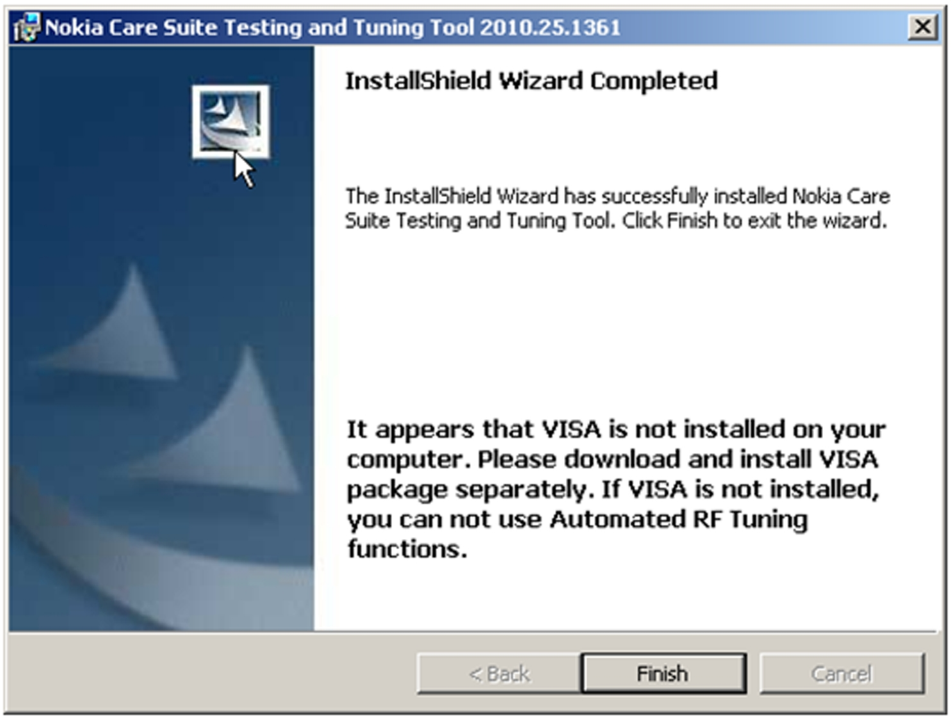
Troubleshooting: Care Suite does not exists

The following info dialog indicates that Care Suite has not been installed. Install Care Suite according the instructions you can find from Nokia Care Suite User Guide.



Troubleshooting: NI VISA not installed reminder

If NI VISA installation was skipped in some reason it is reminded when Care Suite Testing and Tuning Tool installation ends.



Launching Care Suite Testing and tuning Tool

You can launch Care Suite in the following ways:

- If the “Shortcut on desktop” option was selected during installation, double-click the Nokia Care Suite shortcut on the desktop.

- If you used the default installation path, launch the application from *C:\Program Files\Nokia\Nokia Care Suite \ApplicationLauncher\Bin\applicationlauncher.exe* or *Start -> Programs –> Nokia -> Nokia Care Suite –> Launch Nokia Care Suite*.

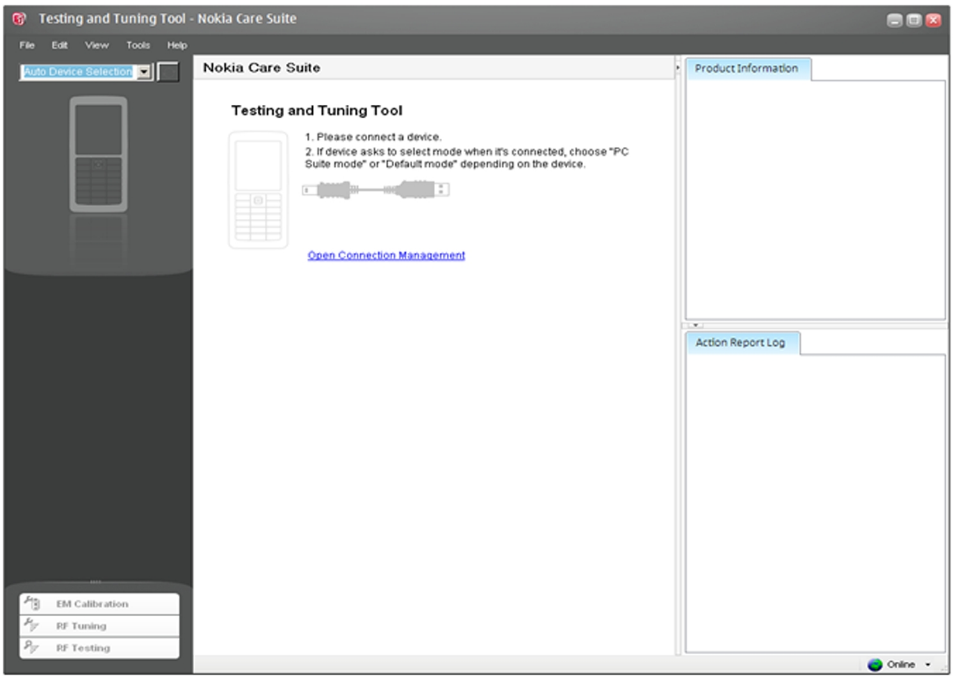
Nokia Care Suite application launcher shows the available applications for use.

Application launcher

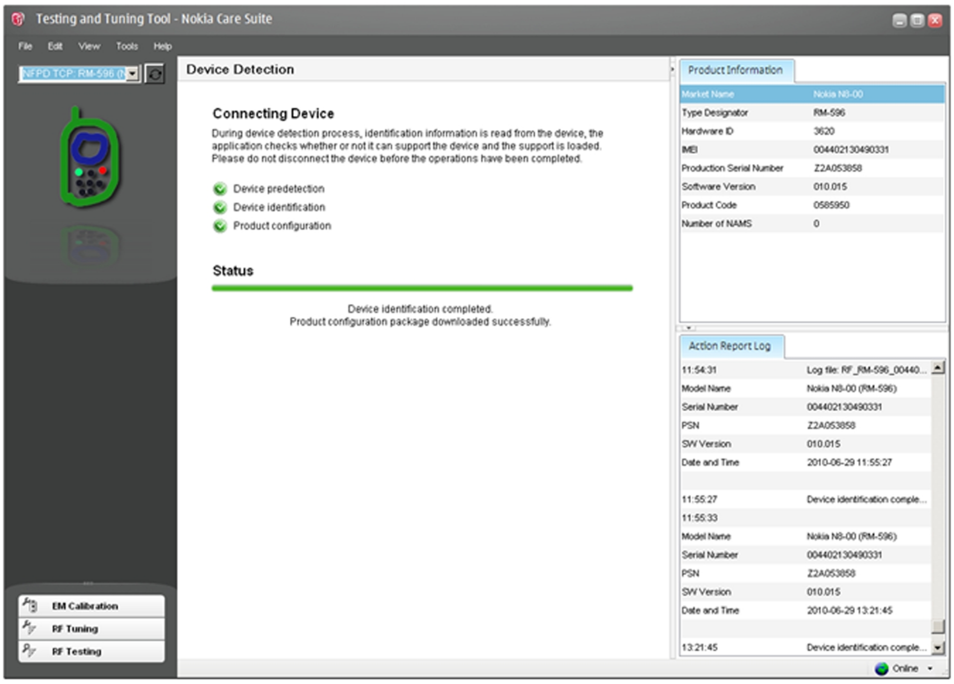
- To launch the Nokia Care Suite Testing and Tuning Tool, double-click on the *Testing and Tuning Tool*.

Layout

- Welcome screen is displayed when Testing and Tuning Tool is started.



- When a device is connected, the device connection screen is displayed.
- The progress about device predetection, identification and product configuration.



Press *Open Connection Management* link to open Nokia Fuse application.

Selection of the connected device

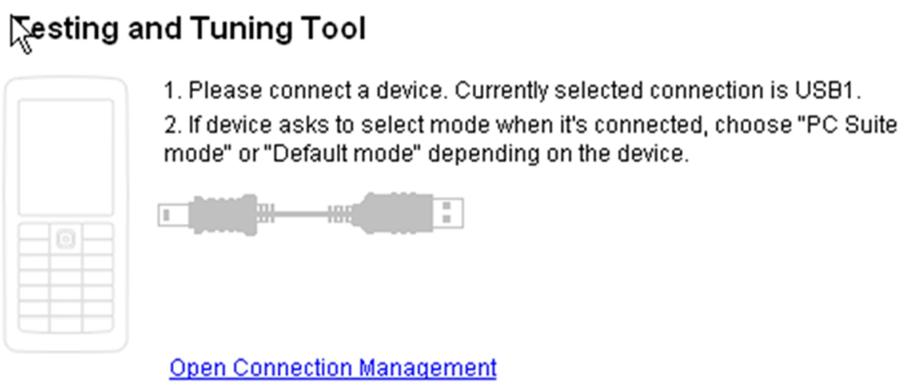
- When multiple devices are connected, use the drop-down menu to select the desired device.
- When you select a device, all the other panels will be updated for the selected device.

In the drop-down menu in addition to the connected devices two items are available:

- No connection – if it's selected the welcome screen is always displayed (even if there are connected devices)
- Auto Device Selection – Care Suite will select automatically active connection (usually first connected device)

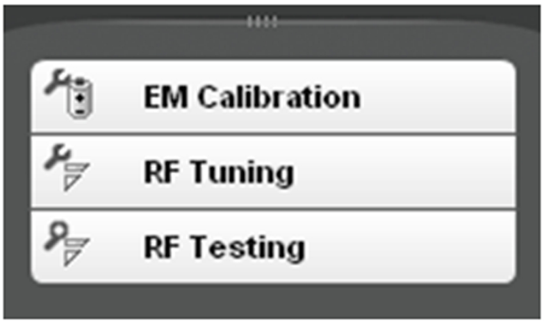
Refresh button besides drop-down menu freshes the connection and behaves like new product is attached and detected (device predetection, device identification and product configuration steps were executed.) Refresh functionality can be used when connection paired with CU-4 service adapter is stuck.

If no device is connected an empty connections are available for selection. If you select an empty connection (connection to which no device is associated) from drop-down menu the welcome screen is displayed:



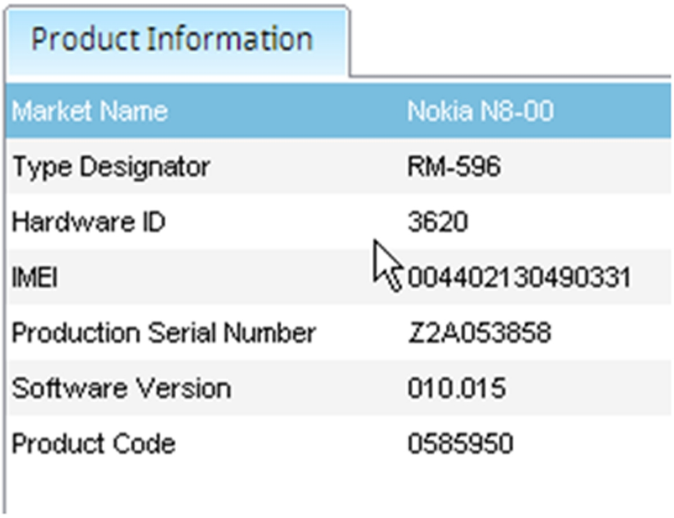
Navigation menu

Select the desired tool. The tools (buttons) can be grayed based on connected device configuration.



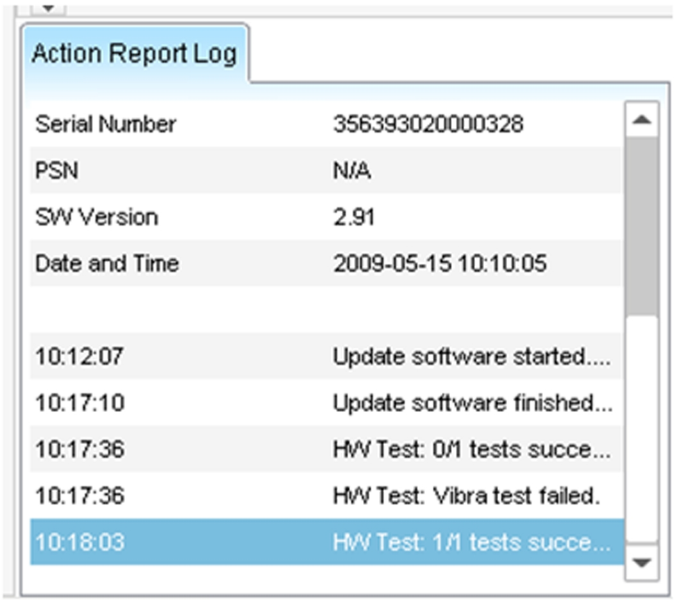
Product Information

Basic information is displayed for connected product. Right mouse click over the Product Information columns make possible to hide items (columns) or make them visible again.



Action Report Log

- Logs all activities done for a particular device by serial number.

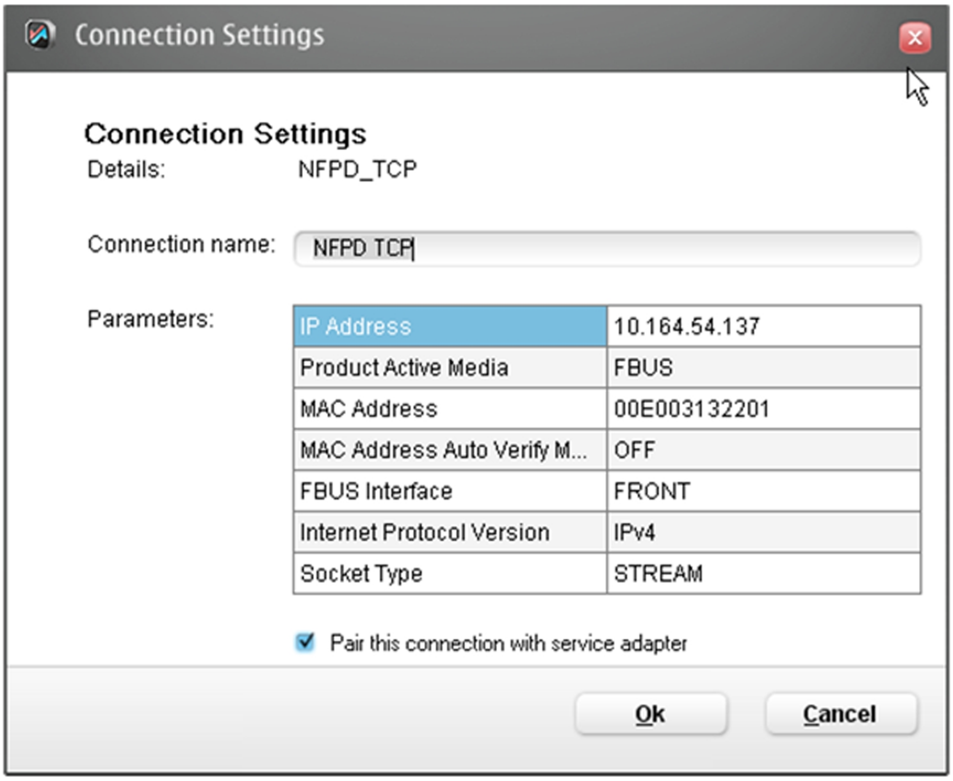


- By default Action Report Log files are located in *C:|Documents and Settings|All Users|Application Data |Nokia|Nokia Care Suite|Logs|Action Reports* and the default storage time is *30 days*.
- Action Report Log path and storage time can be changed in *File -> Preferences -> Logs*.

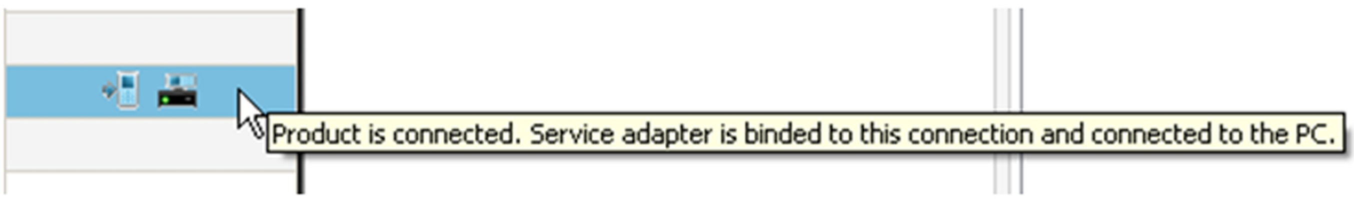
Configuration of testing and tuning tools

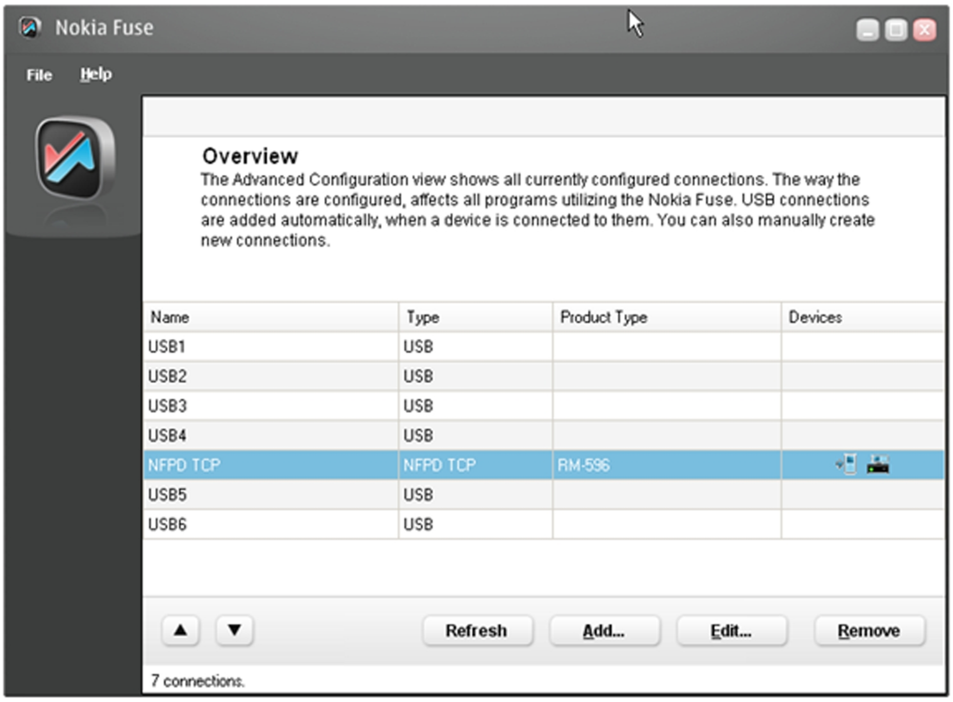
Configure connections between phone and PC

Connections can be managed by Nokia Fuse. This is described in Nokia Care Suite User Guide. One important addition is added here relating Service Adapter (CU-4) used. When connection is configured it must be "paired" with CU-4. Tick "*Pair this connection with service adapeter*" choice in connection settings dialog.



Paired service adapter and connection is visible in Fuse Overview.



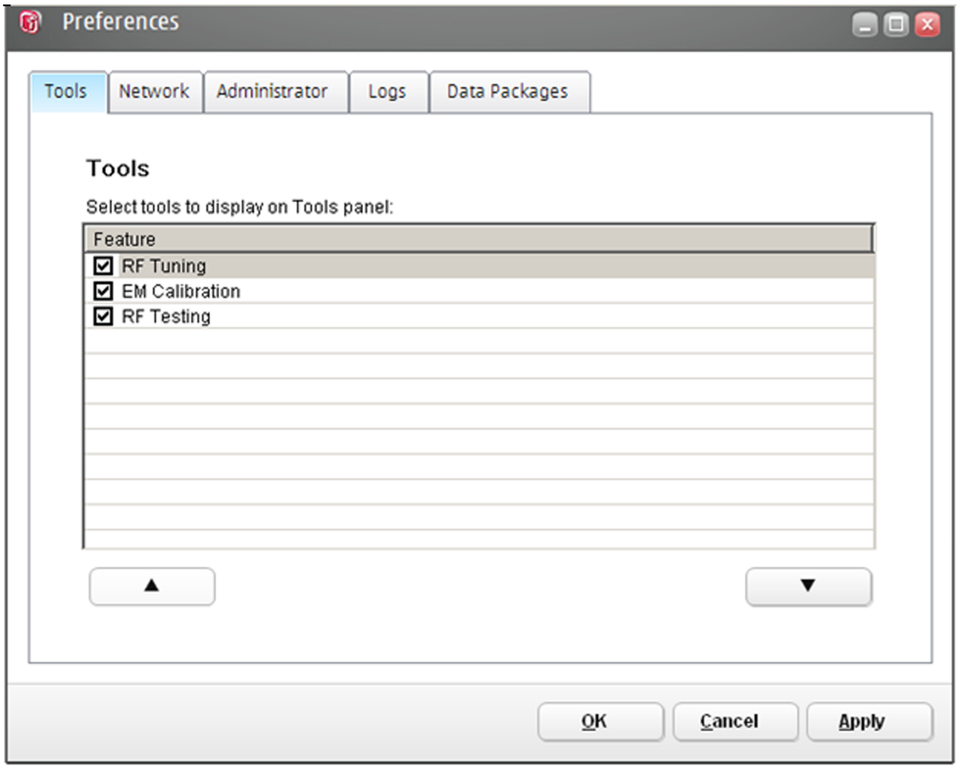


Preferences

Testing and Tuning Tool can be configurated via Preferences dialog. Go to *File -> Preferences*.

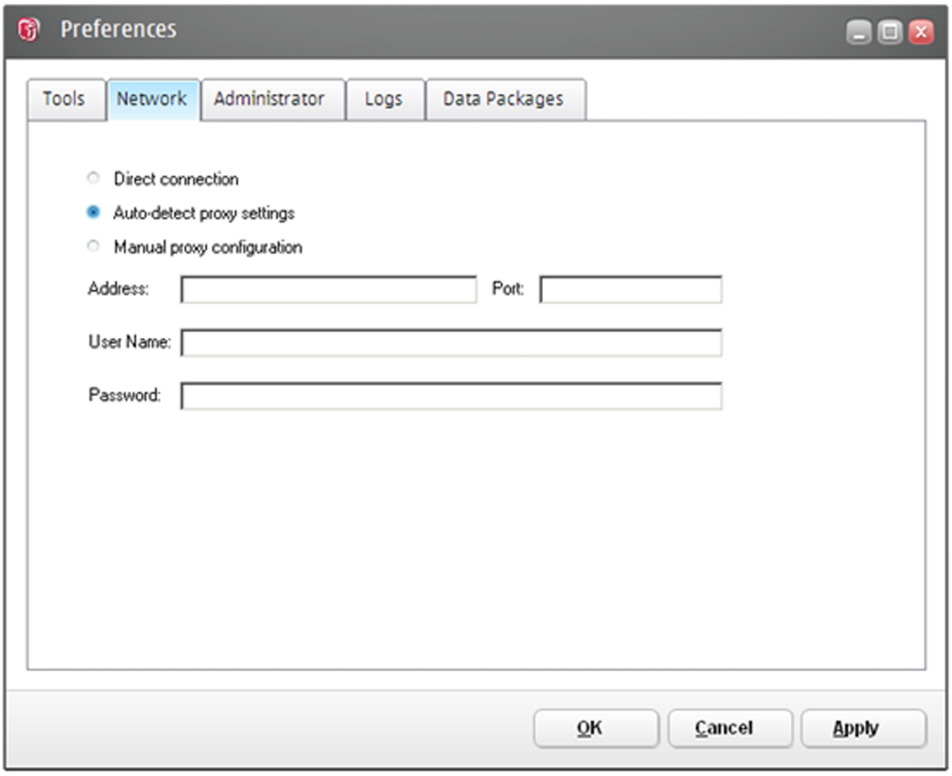
Tools tab

Tools to be shown in tools panel can be configured in Tools tab.



Network tab

Select if you use proxy setting and set configuration if manual proxy has been selected.

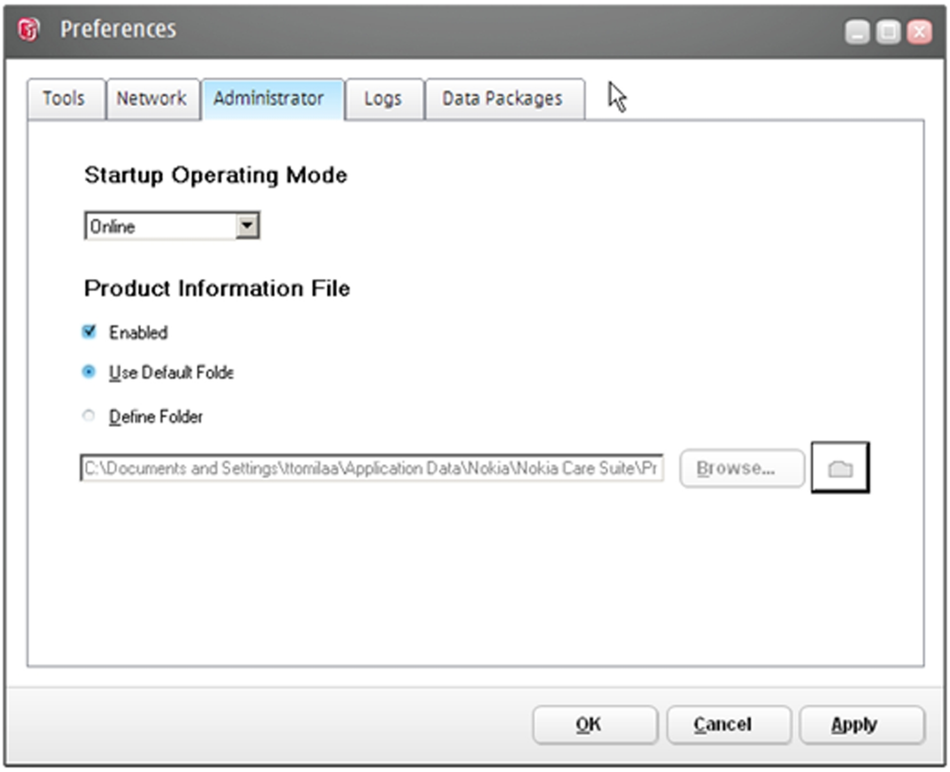


Administrator tab

- Operating mode:

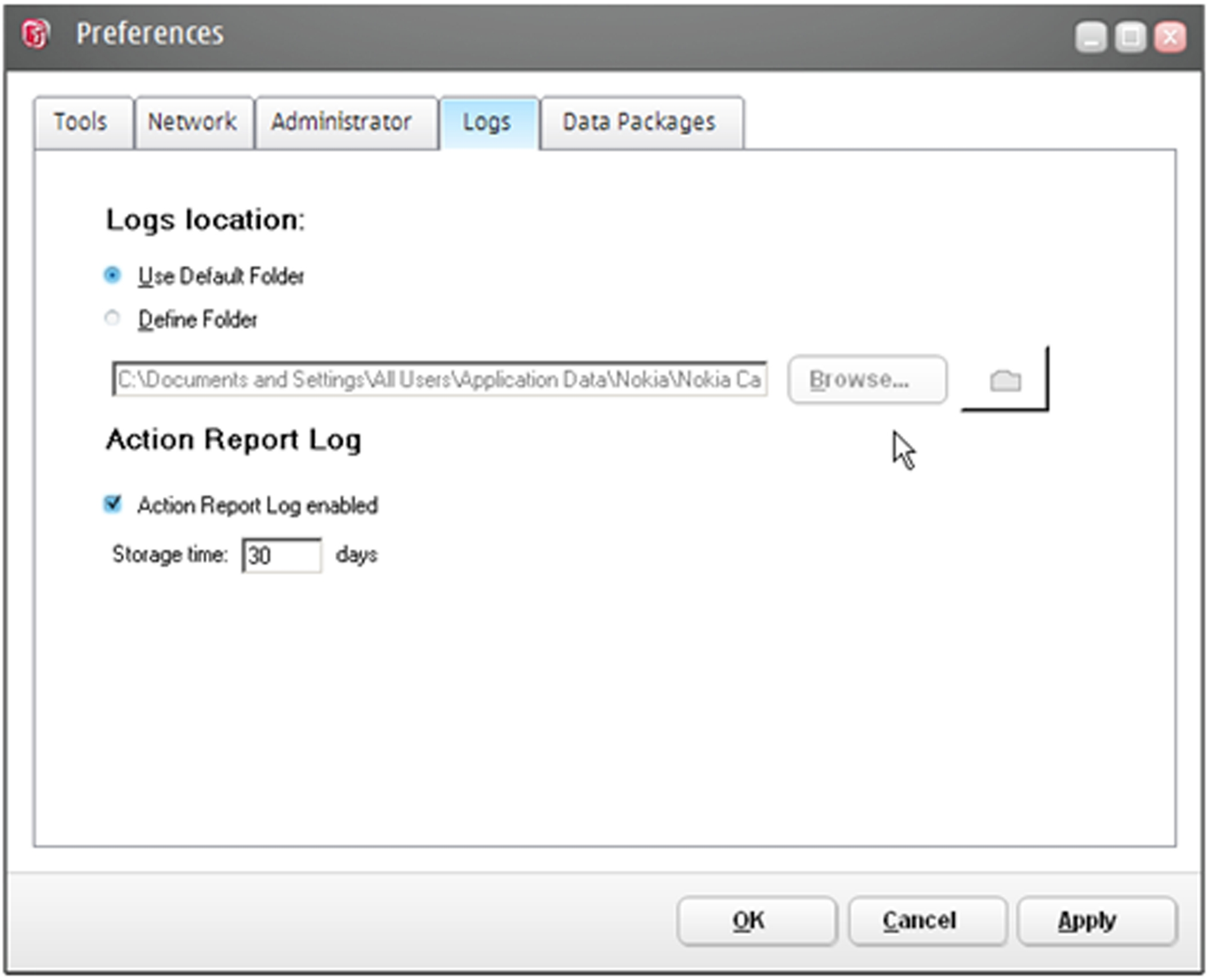
  Select what operating mode of the Care Suite you want to use. Offline mode – will use data packages from local hard drive. Online mode – will try to connect to a server which contains latest data packages.
- Product Information File:

  Select whether you want to disable creation of the Product Information File, use the default folder, or define a folder. Folder icon opens view to folder where Product Information Files are.



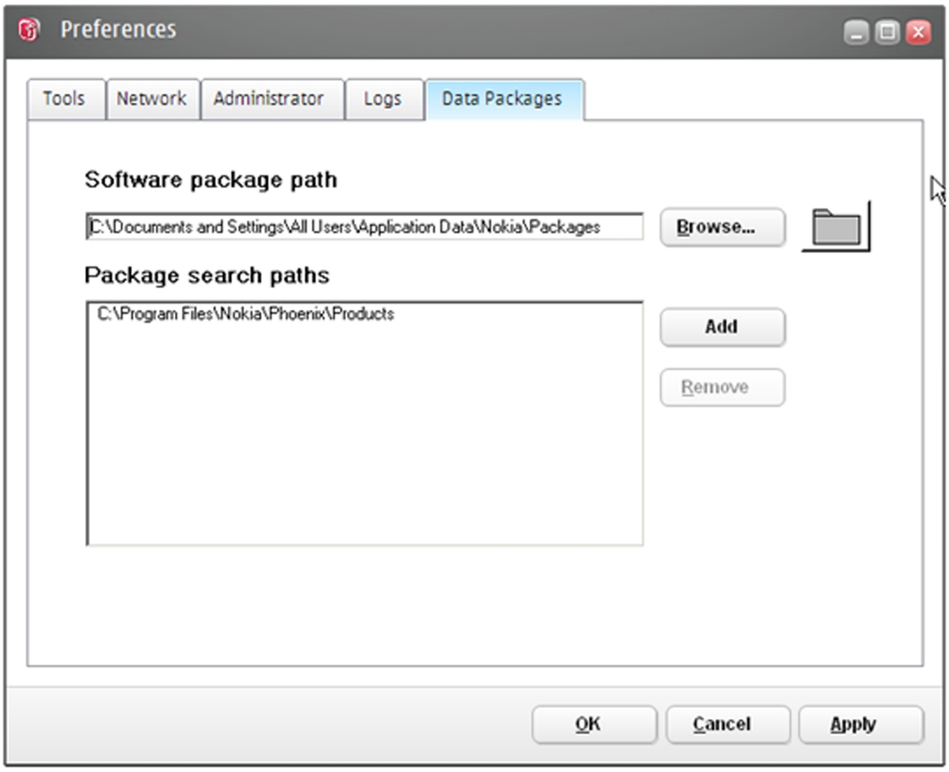
Logs tab

Destination folders for logs files can be configured here.



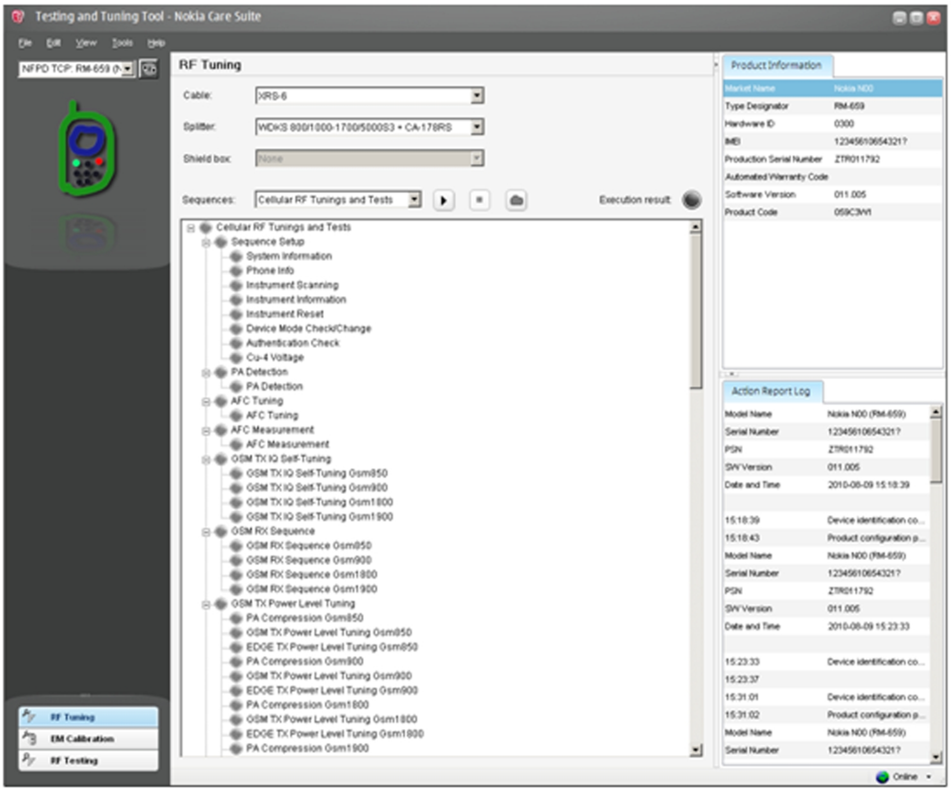
Data Packages tab

- Software package path: Destination path for downloaded data packages. The path is also included by default in package search paths.
- Package search path: List of search paths of data packages.

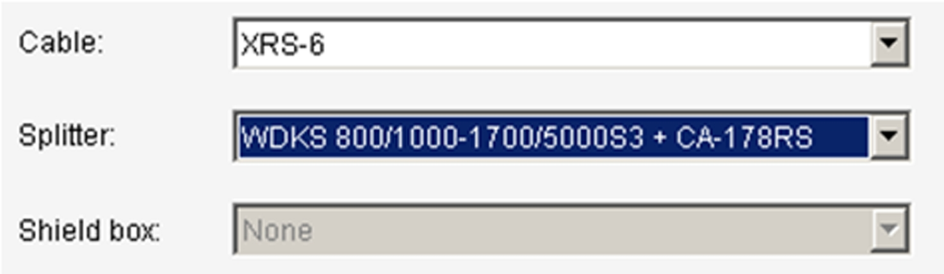


RF tuning

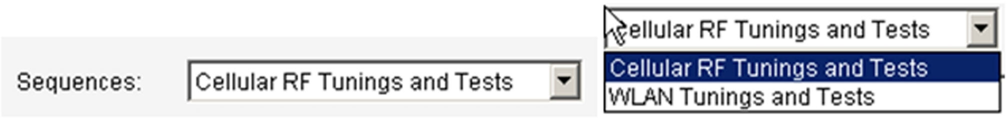
RF Tuning tool is opened from navigation panel or *Tools –> RF Tuning* menu. If data package is found for the attached product the following screen is displayed.



An upper part of RF Tuning Tool (RF Testing Tool too) view has controls for cables, splitters and shield boxes defined by Nokia. A right e.g. cable must be selected because then RF Tuning has different attenuation values for different cables, splitter and/or shield boxes. Splitter consists of splitter itself and cables to splitter (here CA-178RS). Selections in drop down lists remains even though tool is closed and opened again so there is no need to make selection if tuning environment remains from hardware point of view. Note that a product specific loss in the attenuation chain comes from data package and RF Tuning summarizes all losses into one from connection in product/module jig to instrument.



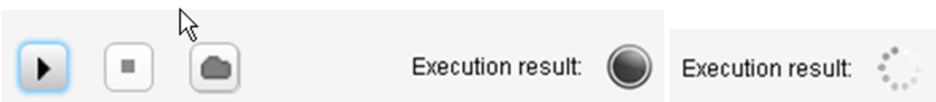
A different kind of RF tunings can be executed by RF Tuning Tool. It depends on product how many different sequences there are. All possible tunings (sequences) are listed in Sequences drop down list (picture below, left one). As an example (picture below, right one) product has two sequences: Cellular RF Tunings and Tests and WLAN Tunings and Tests. Some products may have also FM TX tuning.



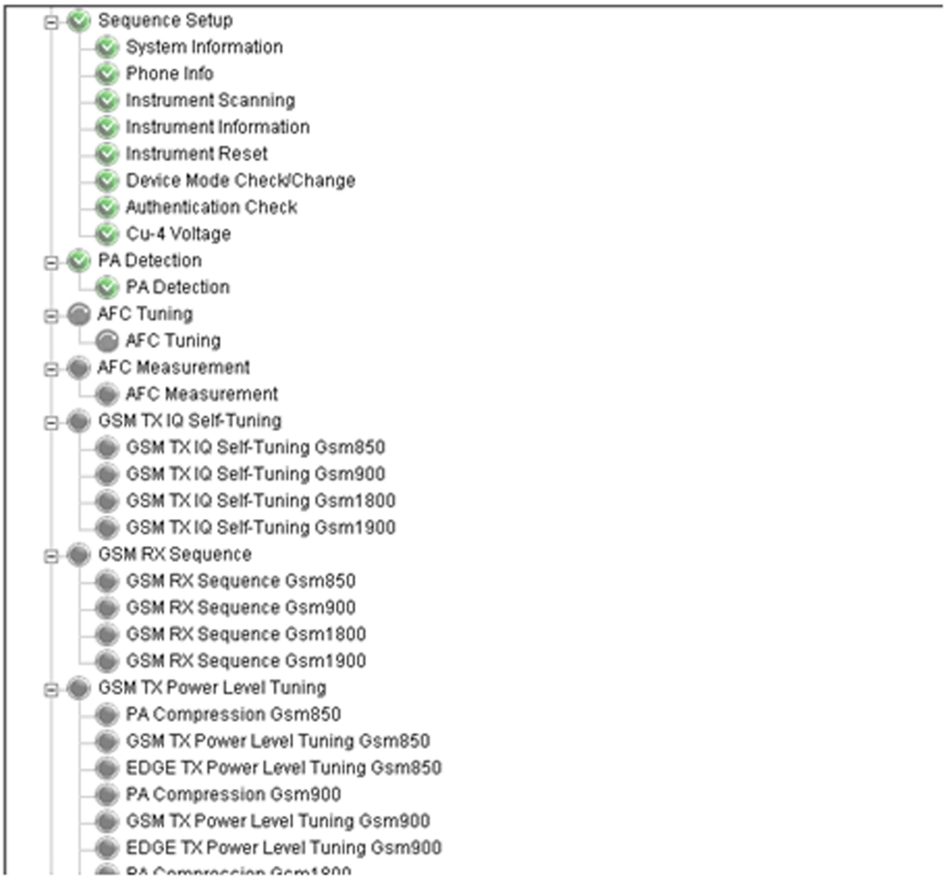
An actual execution for the sequence begins when the user clicks “play” button (picture below, button at far left in three-button group). The execution can be stopped by clicking “stop” button (in the middle of three-button group). It does not stop the execution immediately but an ongoing step in the sequence is ended first. A “folder” button (at the right in three-button group) opens a window where log files, the execution produces, are located.

A status of the execution is shown with the execution result “ball”. A status of the execution is indicated with colors:

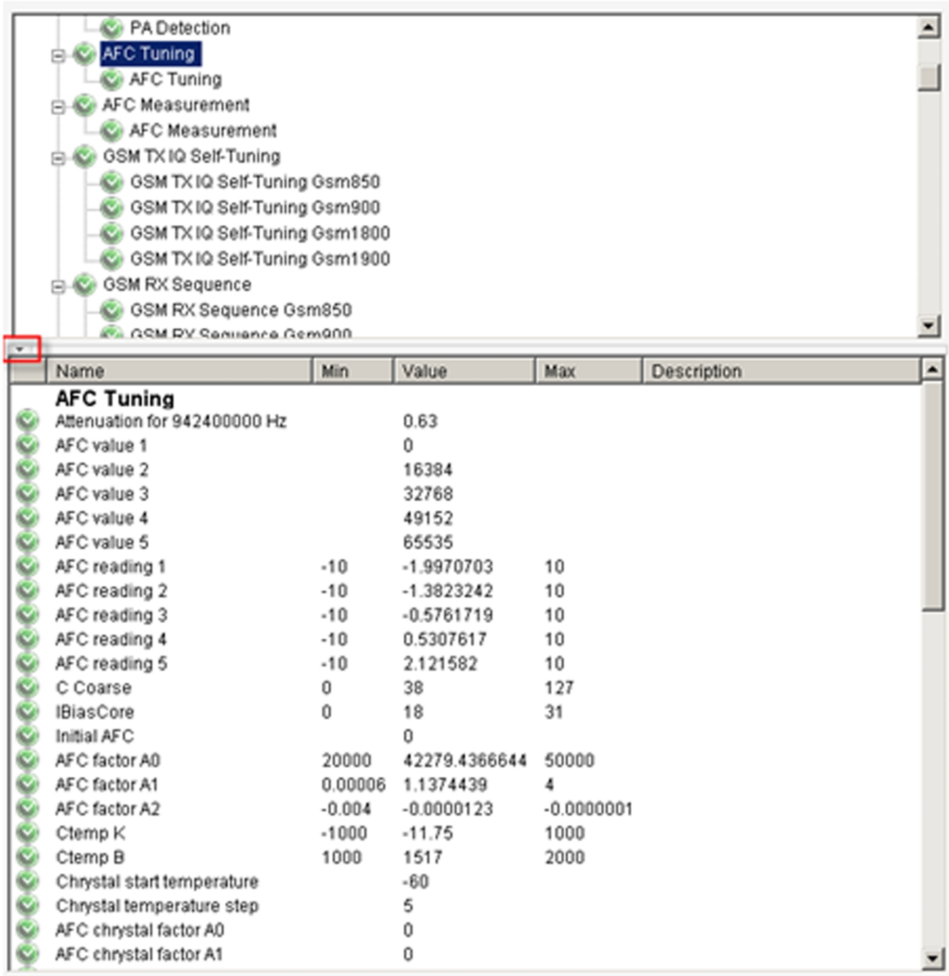
- Grey – the sequence hasn't been executed yet. The ongoing execution is shown as rotating tiny balls.
- Green –the sequence has been executed successfully.
- Yellow – the sequence execution has been stopped and all executed steps were passed successfully.
- Red – The execution was done but some step failed (e.g. limit fail), or the execution stopped due the fail or the execution was stopped and some step in already executed steps failed.



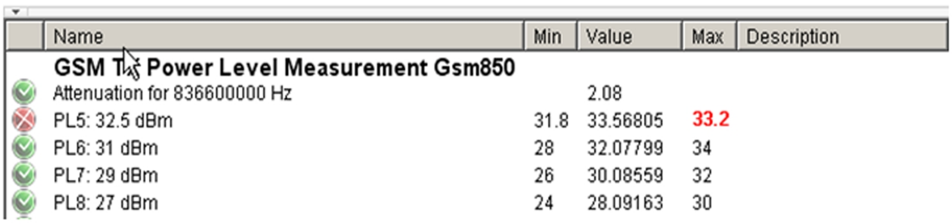
All steps in the sequence are shown in the sequence view (below). The progress of the execution is shown with the status indicators (balls): grey with arrow – the execution of step is ongoing, green – step passed successfully and red – step failed.



The results for the tunings and/or tests can be seen when the execution is ended (stopped by user, stopped due the error or after all steps were executed). If there are “fails” (step status is red), the results for the first fail is shown immediately when the execution ends. If all steps were passed successfully the results are not shown automatically but the user must click wanted step in the sequence view to see results for that step. All results are scrollable by clicking the root of the tree view. The result view can be closed or open again by clicking small arrow (see tiny red rectangle in the middle of the picture below) in the sequence/result view.



Some results are checked against limits. If the value is not between “Min” or “Max” it is shown with red status indicator. It is also shown if the value is below “Min” or bigger than “Max” by highlighting the limit. The limit fail turns also the status of step and sequence to “red”. The limits come from data package and those are product specific.



All information shown in the result view is written to the log file during the execution.

RF testing

RF Testing tool looks visually same like RF Tuning tool. There are same controls for cable, splitter and shield box selections.

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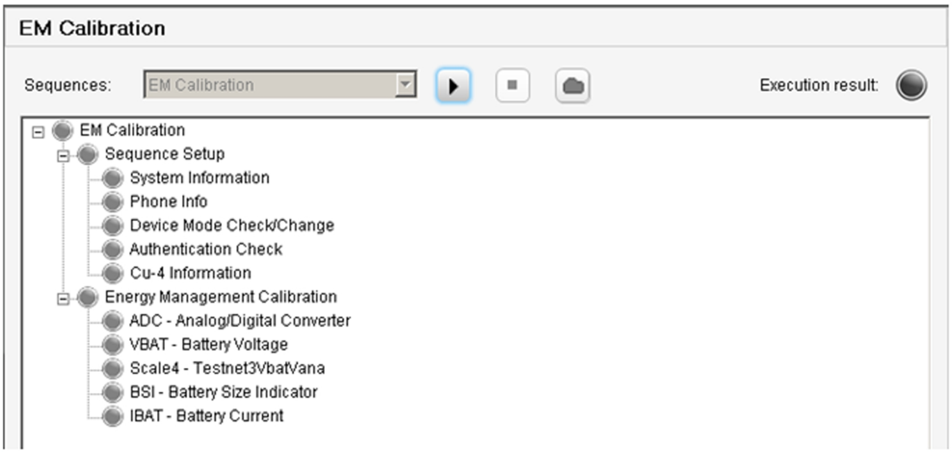
EM calibration

EM Calibration works with same principles like RF Tuning and RF Testing. Some controls like cable, splitter and shield box selection are not visible here. The execution is started and stopped like in RF Tuning and RF Testing.



The results of the execution are shown like in RF Tuning or RF Testing. The results are written to the phone if it is between the limits. If not, then the old value remains in the phone and "saving" step is marked as a fail (red indicator).

Name	Min	Value	Max	Description
ADC - Analog/Digital Converter				
Calculated PM Offset	-49	-4	41	Old value: -2
Calculated PM Gain	12000	13410	14000	Old value: 13384
Saving		OK		Valid values: OK
VBAT - Battery Voltage				
Calculated PM Offset	2635	2727	2755	Old value: 2727
Calculated PM Gain	14900	15361	15900	Old value: 15362
Saving		OK		Valid values: OK
Scale4 - Testnet3VbatVana				
Calculated PM Offset	-100	37	100	Old value: 30
Calculated PM Gain	33000	35357	37000	Old value: 35426
Saving		OK		Valid values: OK

Notes

Bluetooth Troubleshooting

Bluetooth functional description

The device supports Bluetooth 2.1 + EDR (Enhanced Data Rate).

The Bluetooth device UART interface allows the device to communicate with the phone baseband engine using Bluetooth HCI (Host Control Interface) commands. When Bluetooth is switched on, the phone user interface the BT_RESETX line is toggled to reset the Bluetooth device, and commands are sent over the UART interface to configure the device. If UART communication fails (due to a hardware fault) it will not be possible to switch on Bluetooth from the phone user interface.

The device has two clock signals: SYS_CLK (26.0MHz) and SLEEP_CLK (32.768kHz). The SLEEP_CLK is supplied all the time the phone is switched on. To maximise the phone standby time, it is only necessary to provide a SYS_CLK signal when Bluetooth activity occurs, such as sending Bluetooth data to another device, or checking periodically if there are any other Bluetooth devices attempting to communicate with it. At other times when the Bluetooth device is in standby mode it is only necessary to provide a SLEEP_CLK signal. The Bluetooth ASIC is powered directly from the phone battery voltage line (VBAT). An internal regulator is enabled when Bluetooth is switched on.

Bluetooth audio signals are sent to and from the device using a PCM interface. The Bluetooth RF signal is routed via a buried track to the Bluetooth antenna on the side of the PWB. An RF filter is needed between the Bluetooth antenna and Bluetooth ASIC to prevent interference to and from the cellular phone antenna.

Block diagram

The following block diagram shows how Bluetooth is connected to the host engine.

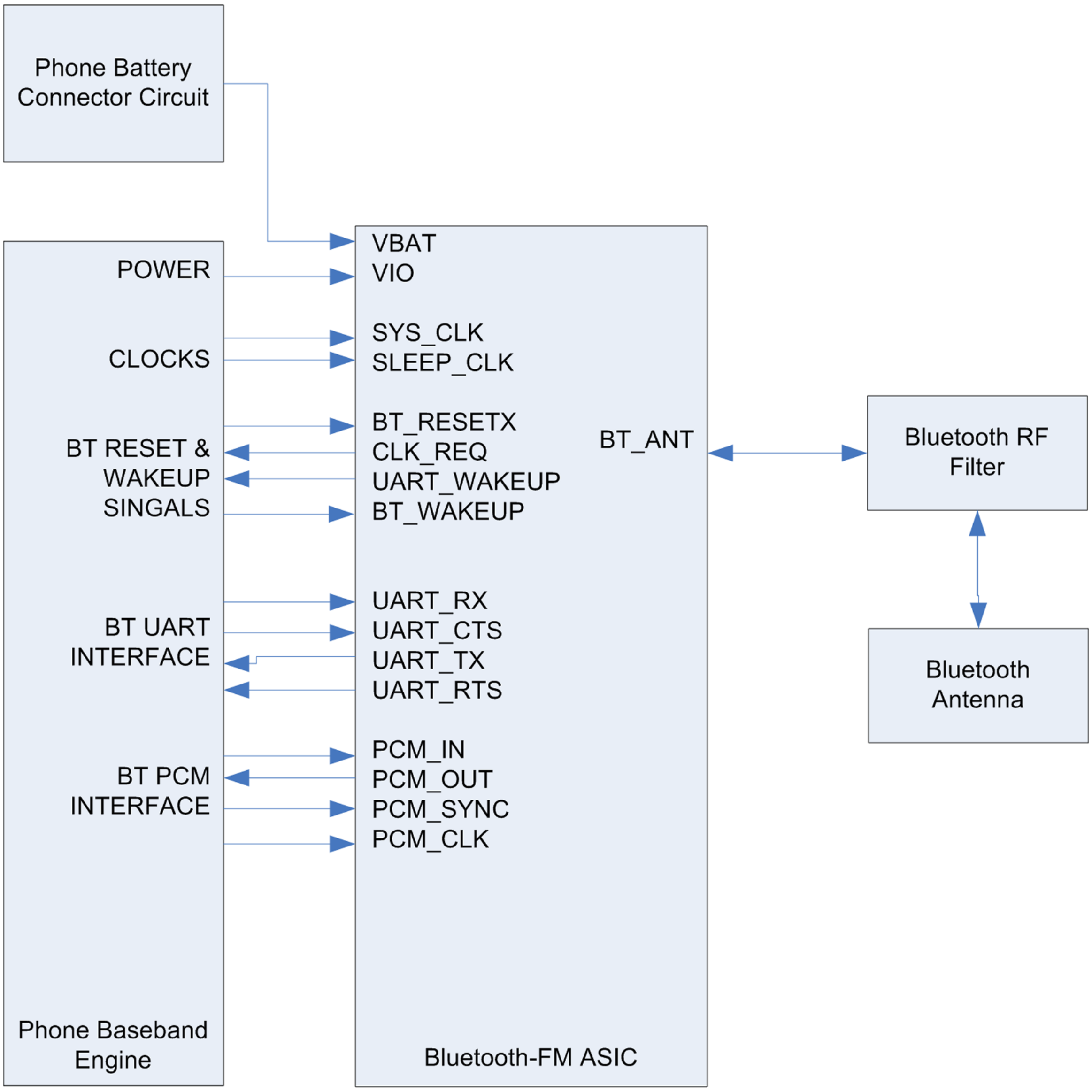


Figure 49 Bluetooth block diagram

Interface signals

Table 2 Bluetooth Signal List

Signal Name	I/O	Function	Notes
RF			
BT_ANT	B	Bluetooth Antenna Port	
Clocking			
SYS_CLK	I	Cellular engine RF clock (26.0 MHz)	
SLEEP_CLK	I	Cellular engine sleep clock (32.768kHz)	
Bluetooth Control			
BT_RESETX	I	Bluetooth ASIC reset	

Signal Name	I/O	Function	Notes
CLK_REQ	O	Signal from Bluetooth ASIC to indicate that SYSCLK is required	
UART_WAKEUP	O	Signal from Bluetooth ASIC to wakeup host engine	
BT_WAKEUP	I	Signal from host engine to wakeup Bluetooth ASIC	
Bluetooth Communication			
UART_RX	I	UART interface to/from host engine	
UART_CTS	I		
UART_TX	O		
UART_RTS	O		
Bluetooth Audio Interface			
PCM_IN	I	PCM interface to/from host engine	
PCM_OUT	O		
PCM_SYNC	I		
PCM_CLK	I		
Power			
VIO	P	Cellular engine I/O supply	
VBAT	P	Phone battery power	Alternative connection to 1.8V supply could be used

Component placement

The Bluetooth ASIC, is checked when troubleshooting (if supported).

The placement of Bluetooth and test probe points is shown below.

The Bluetooth antenna is product specific (PWB track, SMD antenna, clip on antenna, or antenna integrated into phone covers) and is typically located near the side of the PWB.

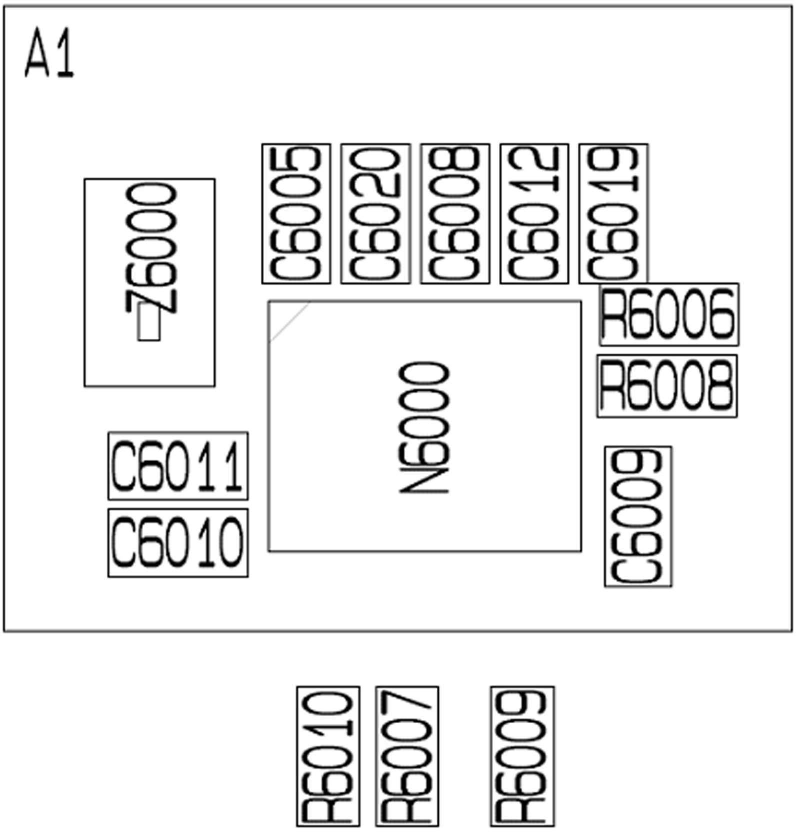


Figure 50 Test points in Archie Bluetooth ASIC circuit – BTHCost4.0D (CSR8810)

Symptom, Problem and Repair Solution

The following problems can occur with the Bluetooth hardware:

Symptom	Problem	Repair Solution
Unable to switch on Bluetooth on phone user interface	Open circuit solder joints or component failure of BTH ASIC, BB ASICs, or SMD components.	Replacement of Bluetooth ASIC
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headset	Open circuit solder joints or component failure of BTH ASIC, BB ASICs (PCM interface).	Replacement of Bluetooth ASIC
Able to switch on Bluetooth on phone user interface, but unable to detect other Bluetooth devices	Open circuit solder joints or detacted component in Bluetooth antenna circuit.	Repair of Bluetooth antenna circuit
Problems connecting to specific manufacturer/model Bluetooth accessory (specific Bluetooth profile supported by phone and accessory in product specification)	Possible interoperability issue with accessory fixed in recent Nokia phone software release (check Nokia Service Bulletin for latest information)	Update phone software to latest version if advised in Nokia Service Bulletin. Note: The phone Bluetooth Address and software version are displayed by pressing *#2820# when Bluetooth is on.

Users may experience the following problems resulting in functional phones being returned to the repair centre:

Symptom	Problem	Solution
Bluetooth feature does not operate as desired with another Bluetooth device	Bluetooth Profile implemented in Bluetooth accessory not supported in Nokia phone	Use Bluetooth accessory with Bluetooth profiles supported by phone

Test Coverage

The tests listed in the table below should be performed to verify whether the Bluetooth is functional.

Bluetooth should be re-tested after repair to the Bluetooth circuit (if supported by the phone).

Test	Test Coverage	Repair solution
Bluetooth Self Test: ST_LPRF_IF_TEST	Bluetooth ASIC UART interface (controls Bluetooth receiver and transmitter)	Replacement of Bluetooth ASIC (or repair of phone BB)
Bluetooth Self Test: ST_BT_WAKEUP_TEST	Bluetooth ASIC interrupt control interface	Replacement of Bluetooth ASIC (or repair of phone BB)
Bluetooth Self Test: ST_LPRF_AUDIO_LINES_TEST	Bluetooth ASIC PCM interface	Replacement of Bluetooth ASIC (or repair of phone BB)
Bluetooth Functional Test: BER test with BT-Box or functional test with other Bluetooth device	Bluetooth antenna circuit	Repair of Bluetooth antenna circuit (including RF filter)

The self tests run from Phoenix software are used for fault diagnosis.

If Phoenix software is not available the functional tests with phone accessories are sufficient to verify the functionality of Bluetooth.

Test Procedure

Bluetooth Self Tests

A CA-101 phone data cable connected to a PC with Phoenix service software is required.

Steps:

1 Connect data cable to phone.

2 Start Phoenix service software.

3 Choose *File* → *Scan Product*.

4 From the Mode drop-down menu, set to *Local*.

5 Choose *Testing* → *Self Tests*.

6 In the Self Tests window check the following Bluetooth tests:

- ST_LPRF_IF_TEST
- ST_LPRF_AUDIO_LINES_TEST
- ST_BT_WAKEUP_TEST

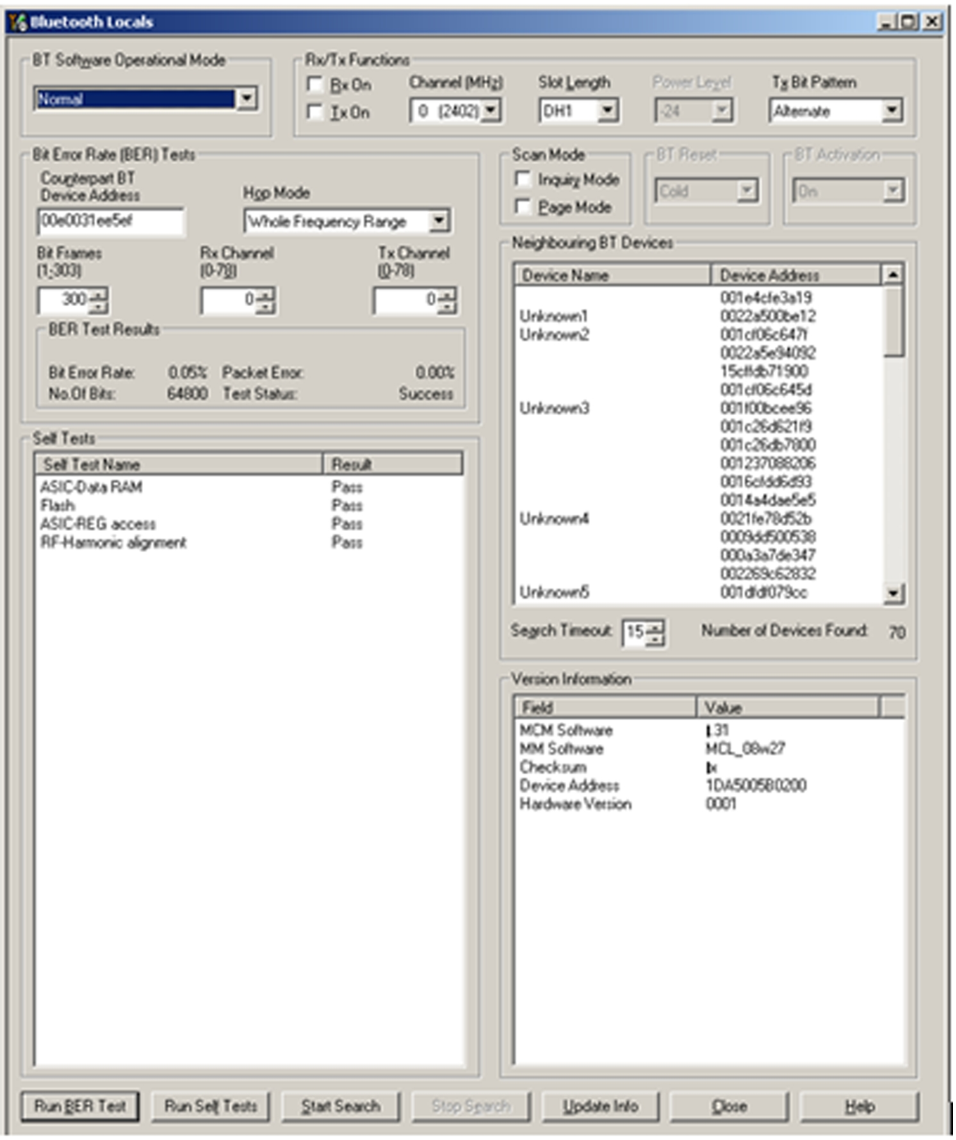
7 To run the test, click *Start*.

Bluetooth BER Test

SB-6 Bluetooth test box (BT-box) is required to perform a BER (Bit Error Rate) test. If a BT-box is not available Bluetooth functionality can be checked by transferring a file to another Bluetooth phone.

Steps:

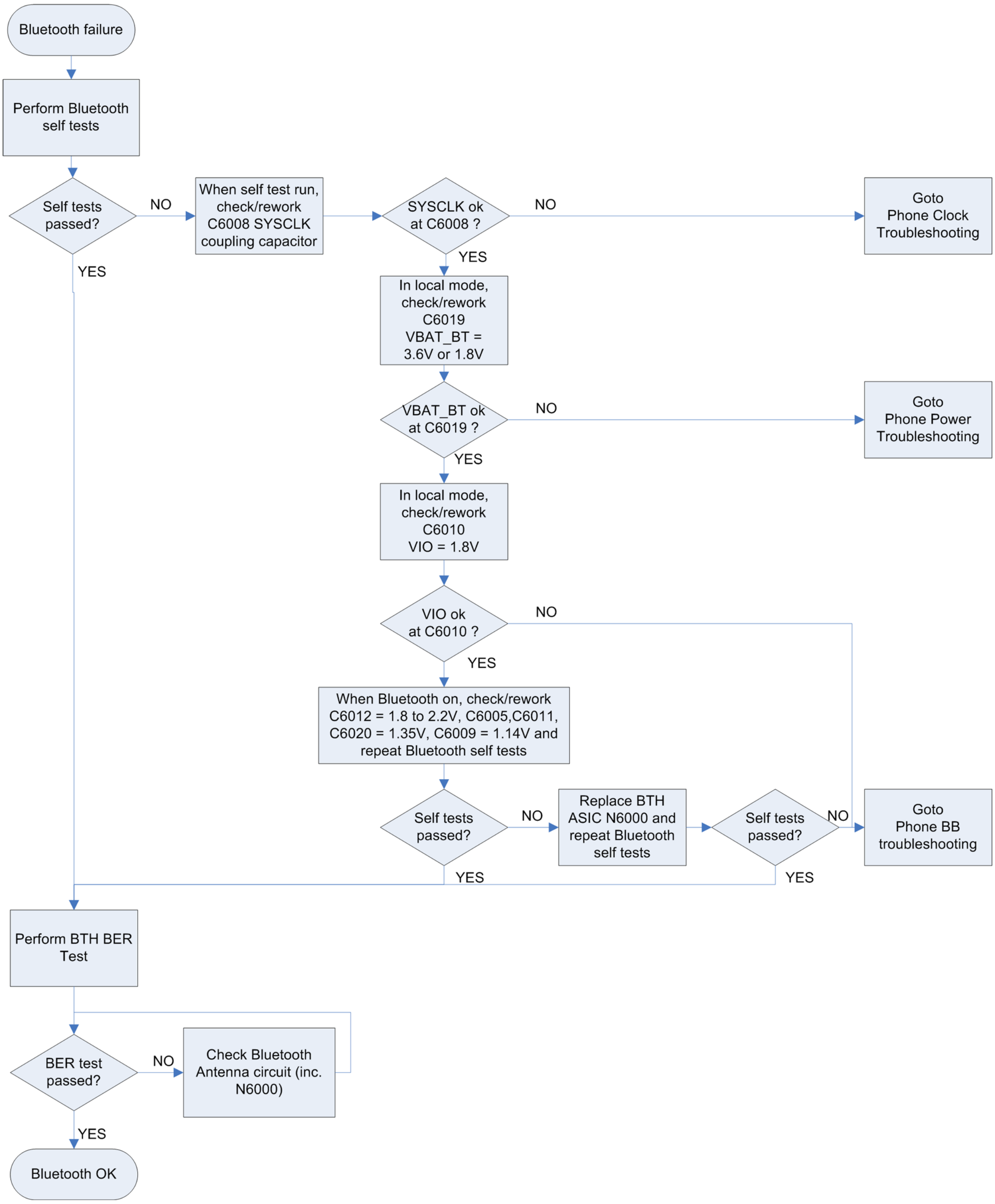
1. Place the phone in the flash adapter or connect data cable to phone.
2. Start Phoenix service software.
3. Choose *File* → *Scan Product*.
4. Choose *Testing* → *Bluetooth LOCALS*
5. Locate the BT-box serial number (12 digits) found in the type label on the back of the SB-6 Bluetooth test box.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the *Counterpart BT Device Address* line.
7. Place the BT-box near (within 10 cm) of the phone and click Run BER Test.



Bluetooth troubleshootin

Troubleshooting flow

The specific troubleshooting fault repair chart only needs to be followed if there is a fault with a particular function.



VBAT C6019

VIO C6010

C6012 1.7 – 1.95

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C6001, C6002, C6003, C6004 no longer present

C6005, C6011, C6020 1.35V

C6009 1.14V

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5 — System Module

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Table of Contents

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Baseband System Module

Overview

This section contains a brief overview of the key features of the Quantum engine, as well as overview descriptions of implementation details.

Introduction: phone description

Quantum is a low cost dual band GSM/EDGE RX platform based on Infineon's X-GOLD213, containing RF transceiver, baseband processor and power management unit on a single IC.

Physical:

- Low component count
- 4 layer PWB, single sided mounting
- PWB structure: 4 layers, 1+2+1 build-up with micro-via

Power:

- Support for Li-Ion batteries
- Support Nokia 2mm charging specification
- Intelligent charge control with temperature and over-current and over-voltage protection

Memory:

- Up to 512Mbit (2Gbit*) NOR flash with burst mode access
- Up to 256Mbit PSRAM
- 296KB internal SRAM
- 1.8V memory supply
- * (constrained by overall IO mapping)

Audio:

- 700mW Class-D amplifier for IHF speaker
- Stereo DC coupled headset outputs
- Polyphonic ringing
- FM radio with RDS
- Voice CODECs. FR, EFR, HR, NB-AMR
- SB-ADPCM CODEC for true tone

SIM:

- Support for both 1.8V and 3V SIM.
- SIM supplied by dedicated LDO

MMI:

- Parallel and serial LCD interface
- Vibrator driver output
- 6 x 5 matrix keyboard with detection of 2 keys simultaneously pressed
- Step up for Serial connected LED's for backlight of LCD and keyboard

Camera:

- Parallel camera interface is natively supported by XG213
- CSI-2 type interface with interface IC

Removable storage:

- MMC/SD card

Accessories:

- Support for Signature type accessories
- Support for headset
- TTY support

Production support:

- Secure boot for flash image download
- USB/Serial protocols for flashing

Chipset and key components

The following table lists all major components in the design on baseband side.

Table 3 Chipset key components

Part Number	Function	Reference Designator
X-GOLD 213 V2.1S	Engine IC	D3100
K5N1266ACM-BT80	32MX16 NOR /4MX16 PSRAM	D3000
STSMIA832	De-serializer for Camera	N3000
BC8810	Bluetooth module	N6000
	26MHz DCXO	B7100
	32.768KHz crystal	B3000

BB block diagram

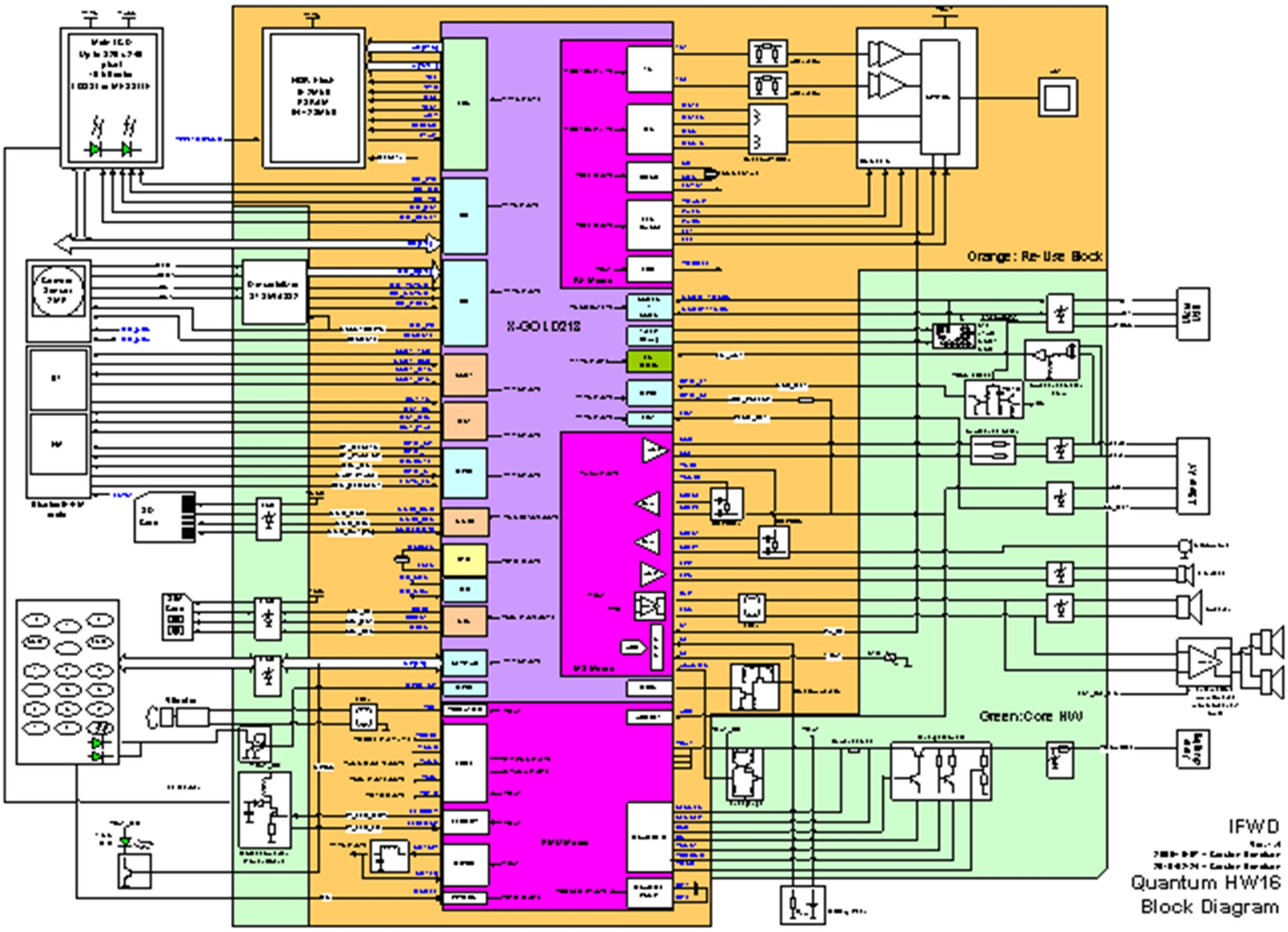

Figure 51 Quantum block diagram

Display

Quantum includes a 128x160, 16bit color display. The display interface has two supply voltages: 2.8V for LCD controller and 1.8V for LCD controller I/O. The display interface is driven by the DIF (Display Interface) of the X-GOLD213. For more details on the DIF please consult the X-GOLD213 spec.

Camera

The Camera is interfaces to the XGold213 trough a de-serializer chip, which converts from the CCP2 serial data/clock from the camera to the 8 bit parallel interface on the XG213.

MMC/SD-card

The MMCI interface of XGold213 is used for external data storage on a SD card. The interface supports up to 52MHz clock rate, giving a peak data bandwidth of 200Mb/s.

Backlight

The LCD backlight is designed around an integrated step-up converter in X-GOLD213, which enables high voltage generation for the serially connected LED's in the LCD.

The current trough the LCD backlight LED's is sensed by a resistor and can be controlled by an XGOLD213 register.

Optionally a separate keyboard backlight can be driven by a constant current sink supplied from VBAT and is controlled from a GPIO. The keyboard backlight supports white LED with low Vf.

Keyboard

The current CHWP is designed with a 5*5 matrix keyboard i.e. up to 25 keys plus the ON key, XG213 can support up to 6*5 which means that up to 30 keys* plus the ON key can be detected. ESD protection is optional by providing PWB footprints for tranzorbers. If needed, these tranzorbers can be mounted. The tranzorber footprints are physically located in a way which enables the use of the Nokia ASIP for keyboard protection, with only minor PWB layout changes.

Note: Usage of the pin for the 6'th row is dependent on the port allocation.

Audio

The microphone, earpiece, speaker and headset are driven directly from the X-GOLD213. To obtain a sufficient Sound Pressure Level from the speaker, a build-in class-D amplifier is used. The design supports both separate transducer implementations as well as combined earpiece and speaker outputs, including support for 3-in-1 devices with integrated vibrator functionality.

The Engine supports two analog microphone inputs and optionally dual digital microphone inputs as well.

Vibrator

The vibrator function is supported using the VIB driver in the X-GOLD213. This driver features a VBAT supplied push-pull output stage which is intended for driving a vibra motor. The engine also supports vibrating using the 3-in-1 multi-actuator device, please refer to 3.3.6.

Accessory support

The accessory connector is the Nokia AV connector. The ECI function is not supported. USB data communication is supported, but USB OTG is not supported. Also Janette headset and video cable are not supported.

Baseband functional description

Baseband functional description

- Baseband function is mainly fulfilled on the XGOLD213 IC, which includes energy management, analog and digital baseband. It has following function: Power supply for internal function blocks, and external chips, like Bluetooth and external memory.
- MCU and DSP to control system in different operation modes.
- State machine of PMU in X-GOLD213 controls the power up sequence.
- 26 MHz and 32 KHz clock generation and distribution.
- Audio CODEC, power amplifier for loudspeaker, microphone (include digital microphone), earpiece, headset.
- Battery interface and battery charge interface.
- Display interface.
- External NOR flash & PSRAM interface.
- External dual SIM card controller to extend up to two SIM card interfaces.
- Display backlight and keypad backlight driver.
- Keypad interrupt and scan.
- Deserializer for camera with serial interface.
- Support 4-bit SD memory card.

- Drive vibrator.
- Support Bluetooth and FM module through UART and I2S ports.

System power up

The system power up sequence can be seen in the following figure.

The Power-on reset (POR) circuit and the LPBG are directly connected to the battery, If the battery voltage exceeds the POR threshold (2.5V), the POR is released, the LRTC and LPMU voltage are switched on and the internal PMU oscillator is started.

The power up sequence can be initiated by any of the following ways if there is a battery of a valid voltage of above SYSONLEV (3.2V):

- First connect of VBAT with valid voltage has been detected
- Input “On” pin pressed (goes from low to high)
- Input RTCOUT caused by programmed alarm in RTC block
- A valid charger detected and the battery is charged above the SYSONPRE voltage level
- A USB cable has been connected (external circuit)

The first startup of the PMU is based on local 50 kHz PMU oscillator. This eliminates delays caused by slow startup time of the 32 kHz RTC oscillator. The SW can later change the input for the PMU clock to the 32 kHz oscillator and switch off the PMU oscillator to save power. The PMU power up sequence is shown in the figure below:

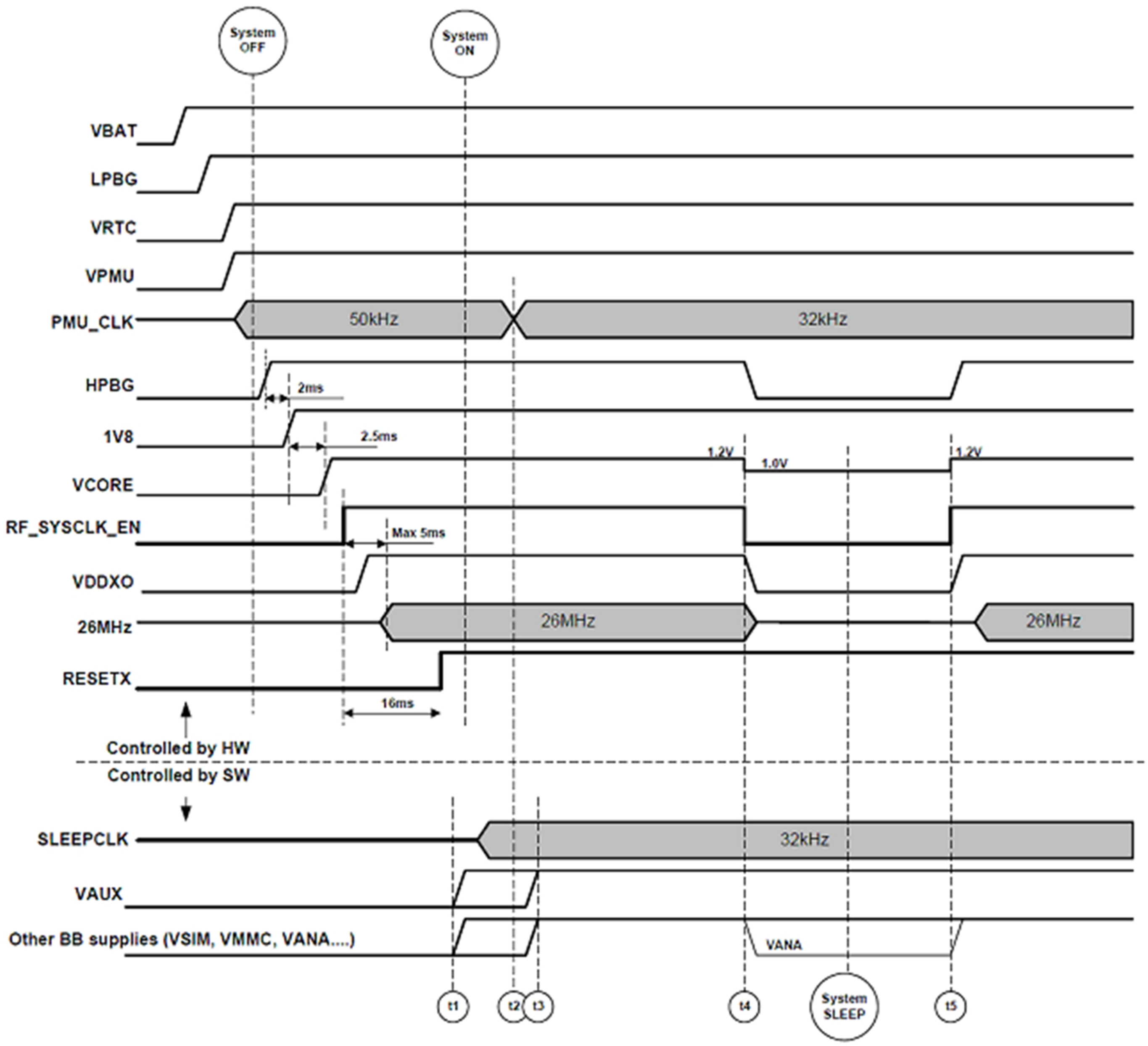

Figure 52 Power up timing and system sleep

Where the system after VBAT is applied goes first into the system OFF state. Connection of a valid battery voltage (VBAT > 3.2V) will initiate a system startup, other valid system startup causes are pressing the ON key, connection of a USB cable or charger, or a RTC alarm event.

When the system is in OFF state, only VRTC and VPMU are activated, with the common reference generated by the low power band-gap reference LPBG. Upon detection of a valid turn-on event, first the high precision band-gap reference is turned on, then the 1.8V step-down converter SD1 and the VCORE LDO are turned on controlled by the PMU HW state-machine. The control signal RF_SYSCLK_EN is asserted to power up the DCXO regulator in the RF macro, and after the DCXO has stabilized, the 26MHz system clock is available. The RESETX signal is released 16ms after assertion of RF_SYSCLK_EN.

When RESETX is released, activation and control of the remaining supplies is done by SW, hence no exact timing figures can be given here. The SW will, as one of the first actions, enable the 32 kHz oscillator and enable the digital SLEEPCLK output, and turn on the 2.85V VAUX regulator. Control of remaining supplies (VSIM, VMMC, VUSB, RF supplies) is handled by the respective SW drivers.

The following figure provides a more SW oriented view of the system startup or boot process. The upper part contains the HW controlled part of the startup sequence up until release of the RESETX reset signal. After this the boot ROM starts executing, validating the flash PSI and detecting if a flashing process is requested over the USB interface.

Depending if a flashing process is requested or not, the boot ROM code will either exit and the flash PSI followed by normal system code will be executed in the case of a normal startup, or the flashing process will be initiated by downloading and executing the RAM PSI from the flashing host.

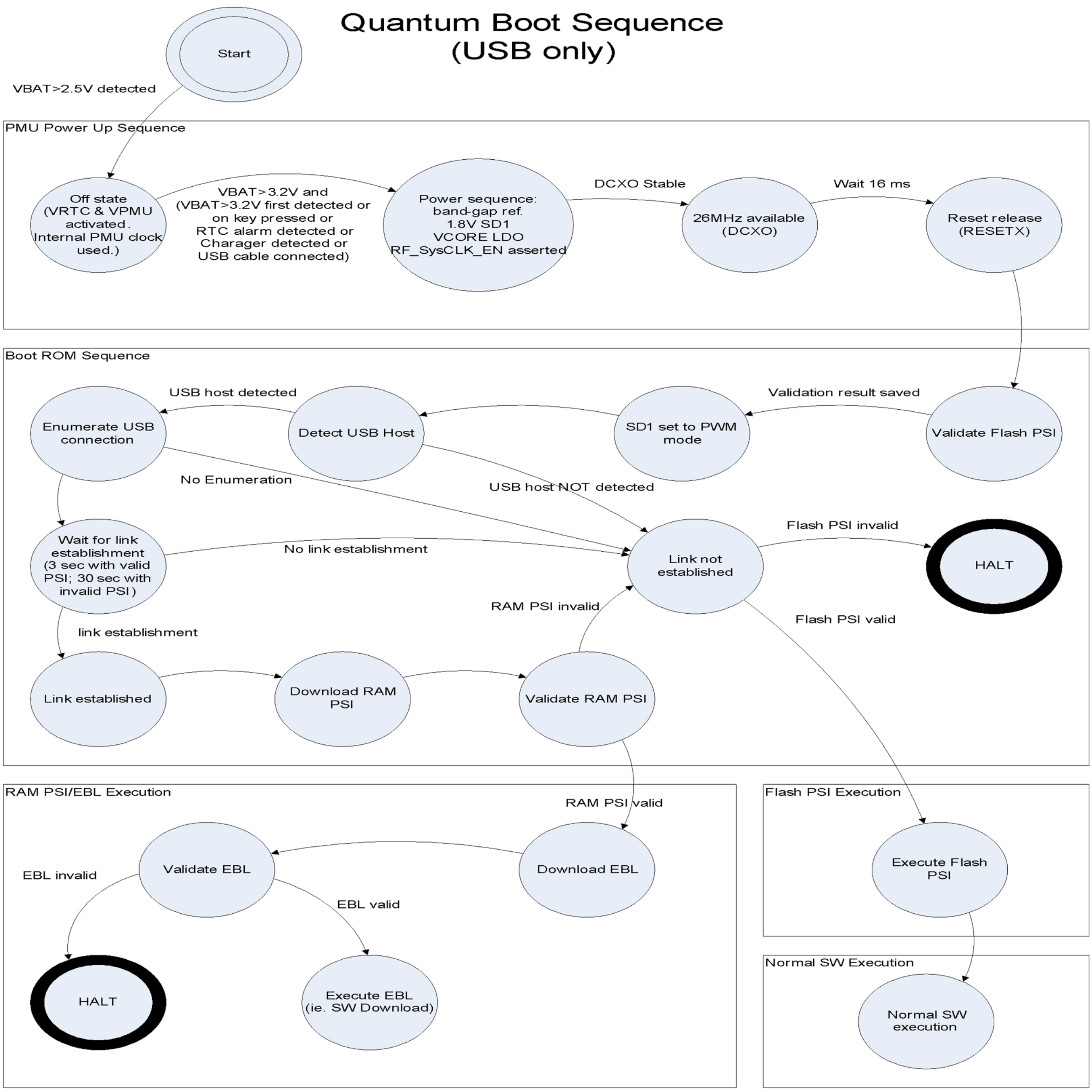

Figure 53 System startup, SW view

Modes of operation

Figure 2 also shows the sleep mode transitions in a PMU context. When the system enters sleep mode, the state of a number of the power management functions will be changed controlled by the RF_SYSCLK_EN signal to reduce current consumption. Most devices can be put into off or standby mode such as the LDOs and DC/DC converter, to minimize quiescent current. The DC/DC converter can be programmable into its low power mode (PFM) and VCORE changes the output voltage to a lower value. The HPBG (HIGH PRECISION BANDGAB) is deactivated and the DCXO in RF is switched off.

Exit from sleep mode is initiated by expiration of the sleep timer or detection of a HW interrupt.

Power distribution

The X-GOLD213 contains regulators for all power supplies needed in various parts of the chip. The regulators are LDO type linear regulators except the 1.8V step down DCDC converter. The LDO's are powered from either battery or the step down converter. The following figure depicts the complete power management unit with the regulators. Supply inputs VRF1 and VDD1V8 are connected to the output of the step down converter SD1, thus increasing the efficiency of the downstream supplies for the RF, the digital core and the analog part by the conversion factor of the step down. The remaining regulators are supplied directly from the battery voltage.

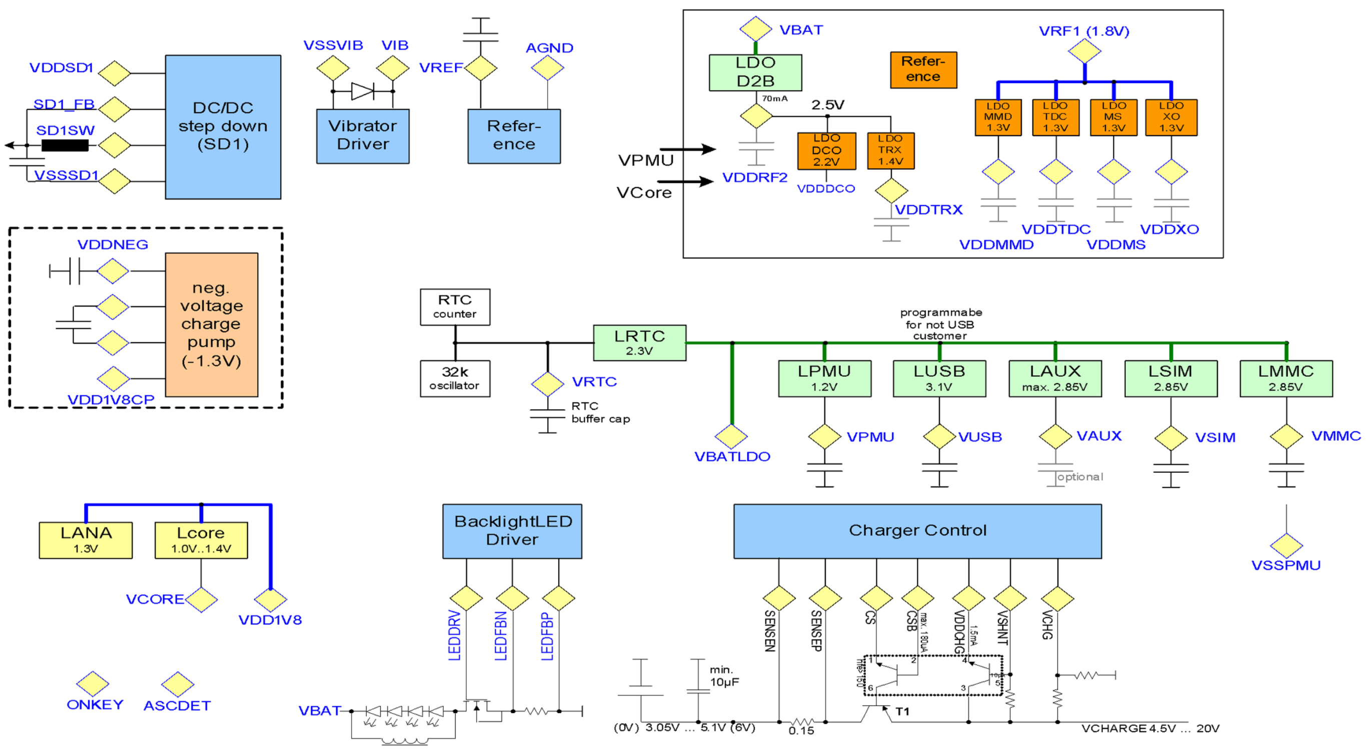

Figure 54 X-GOLD213 power management unit

The above figure shows the VPMU, VMMC, VSIM, VRTC, VUSB and VAUX LDO outputs of X-Gold213 together with the output decoupling capacitors. VANA is implemented with a cap-less LDO, hence this supply is not available on any X-Gold213 balls. Main part of the system is powered from a 1.8V supply rail. This voltage is generated by the integrated step down converter (SD1) which needs only an inductor L2204 plus input and output decoupling capacitors C2207 and C2206.

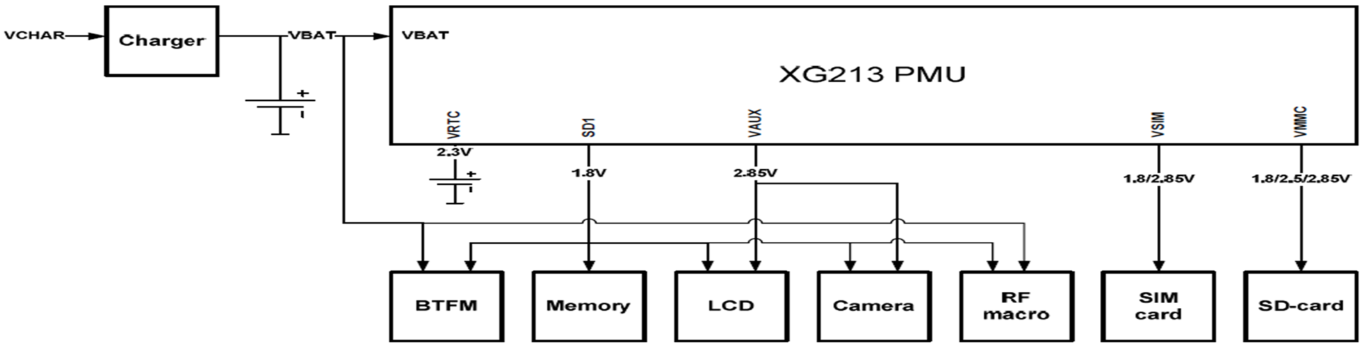

Figure 55 Power supply distribution

The above figure shows the power supply distribution of Quantum for the supplies which are used outside the X-Gold213. Regulators in the X-GOLD213 convert the battery voltage VBAT to regulated supplies for the various peripherals. The SD-card features dedicated regulator. A shared supply concept is used for other peripherals. This means in general that there is no power on/off control implemented for the shared supplies, these regulators will be enabled always when the system is on.

Clocking concept

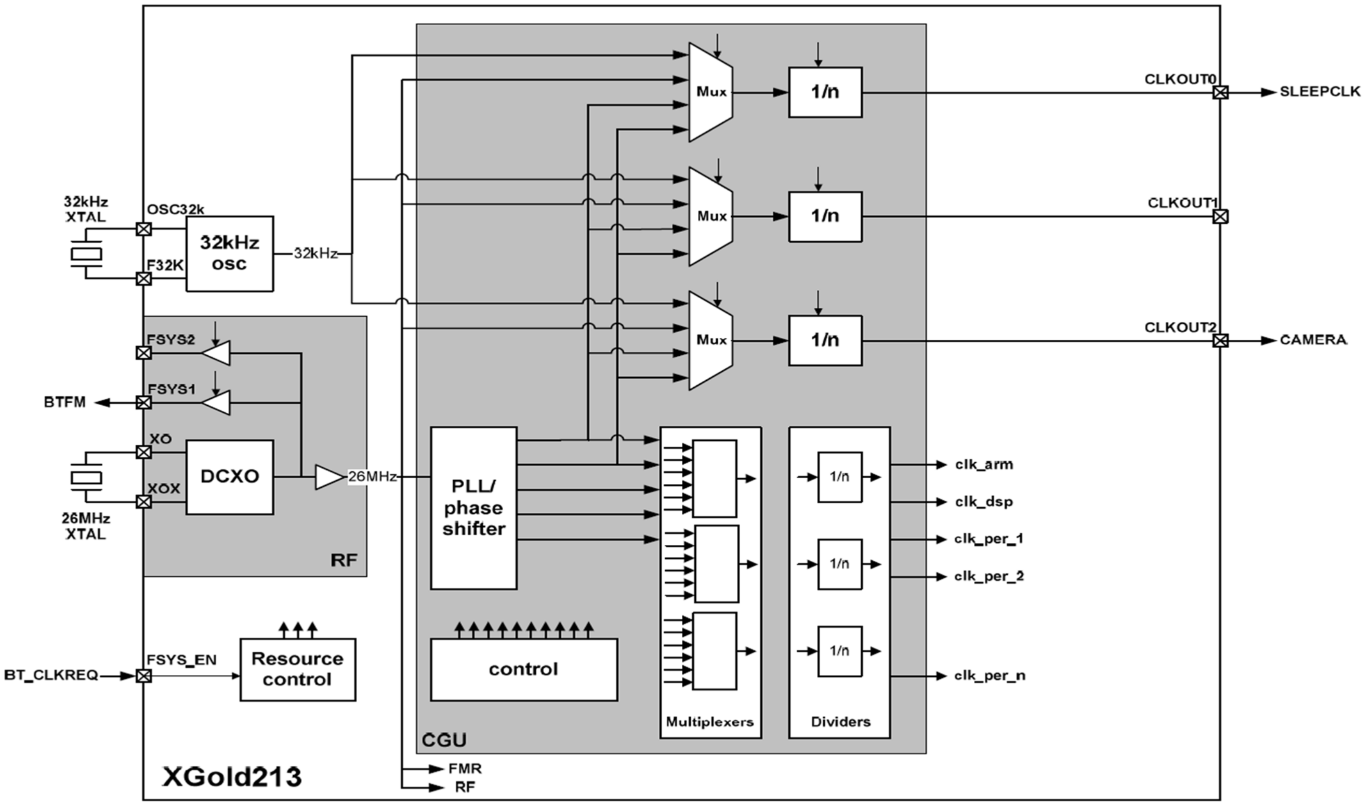

Figure 56 XG213 clock generation and distribution

The above figure provides an overview of the clock generation and distribution inside XGold213. The 26MHz DCXO is located in the RF macro and supplies the XGold213 with the main clock input. This clock is optionally available also on the FSYS1 and FSYS2 outputs as sine wave outputs. In Quantum only FSYS1 is used for the BTFM module. The 26MHz signal from the DCXO is buffered and made available for the digital part of the XGold213 through the CGU (Clock Generation Unit). Here a PLL and phase shifters generate higher frequency clock signals which are then fed to the various on-chip HW blocks through a set of multiplexers and dividers, allowing for a very flexible clocking scheme. The clocks are also available a digital clock outputs on the CLKOUT [0:2] balls. Currently in Quantum CLKOUT0 is assigned for the 32 kHz SLEEEPCLK, and CLKOUT2 is assigned for the camera clock, and CLKOUT1 is not used.

The low power 32 kHz oscillator is enabled under SW control and is available during system sleep for all HW blocks to allow operation is sleep mode with very low power consumption.

Audio concept

The VMIC supply is intended for the biasing of the internal microphone and the VUMIC for the biasing of the headset microphone. There are 4 voltage settings for VMIC and VUMIC ranging between 1.8V and 2.2V. The default setting for both supplies in XMM2130 reference design is 2.2V. VUMIC has an ultra-low-power mode which is used only when a headset is connected and the mobile station is in sleep mode. To be able to detect a key press on the hook key, the bias supply needs to be enabled. VUMIC is switched to the standard mode during audio operation for optimal noise performance.

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The internal microphone inputs via filtering components to the MICP1 and MICN1 inputs of XGold213. DC blocking capacitors C2102 are inserted to center the audio input around the internal bias level. The microphone circuit is configured in pseudo-differential mode. VMIC is used for the bias. A low-pass filter comprising R2100 and C2101 is used to remove any potential noise picked-up by VMIC. The external microphone for the headset is connected via filtering components to the second differential microphone input MICP2 and MICN2, and is designed pseudo-differentially for better noise immunity. DC blocking capacitors C2107 are used for the biasing. A low-pass filter comprising R2105 and C2105 removes any potential noise picked-up by VUMIC. As a relatively high gain is applied to the uplink signal in the X-GOLD213, a noise suppression filter is inserted. Microphone signals are connected differentially between X-GOLD213 and filter circuitry in order to achieve a good common mode noise rejection.

Downlink audio can be routed to the headset output drivers, earpiece driver or the class-D speaker amplifier.

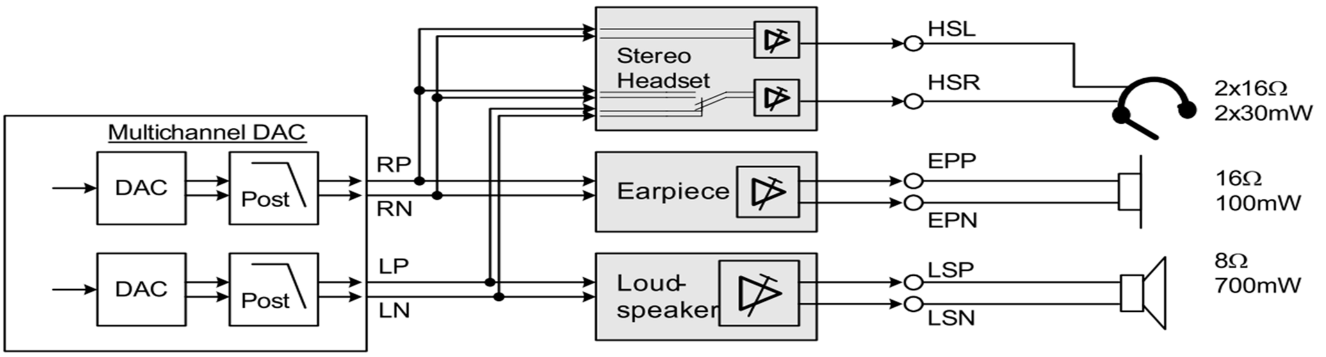

Figure 57 X-Gold213 audio output selection

The X-Gold213 features stereo headset drivers, each driving a 16ohm load with an output power up to 30mWrms. With different register settings, either a stereo or mono configuration can be selected. In the mono configuration, only the R-DAC is used, with the signals still routed through to both HSR and HSL. The X-Gold213 also contains a charge pump which is used to supply the internal headset amplifier in bipolar mode (generates -1.3V). When using this mode, the external DC blocking capacitor can be removed. For Quantum only bipolar mode will be supported. For this application an external capacitor C3016 is connected to the CP1 / CP2 balls. The charge pump is driven by a 13 MHz clock.

The EP buffer (EPP and EPN) is specified to have a max power output of 100mWrms, at a load16ohms.

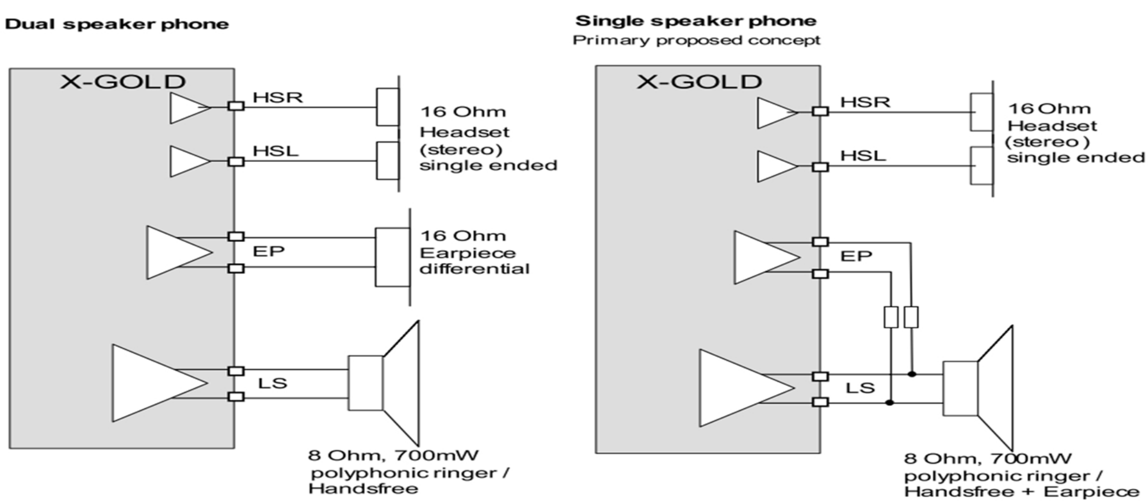

Figure 58 Dual and single speaker configurations

Quantum supports dual or single speaker configuration. Single speaker configuration is used when having either just a single speaker for both IHF and normal handset operation, or when using a multi-actuator or 3-in-1-device with integrated vibrator functionality. For single speaker configurations 3.9 Ohm serial resistors must be inserted in the earpiece driver outputs as indicated in the above figure to isolate the driver from the low speaker impedance.

The X-GOLD213 has an integrated Class D power amplifier (LSP/LSN) that can drive an 8ohm load at the maximum rating of 700 mW rms (at VBATmax). The Class D amplifier is supplied directly by the phone battery and therefore the driving capability depends on the battery voltage.

The default switching frequency of the amplifier is initially set to approximately 600kHz, but may be varied between 400kHz to 800kHz in the case of harmonic interference to the GSM RF frequencies or FM radio receive channel. External ferrite beads L3100 and L3000 have been added on the amplifier outputs to minimize interference.

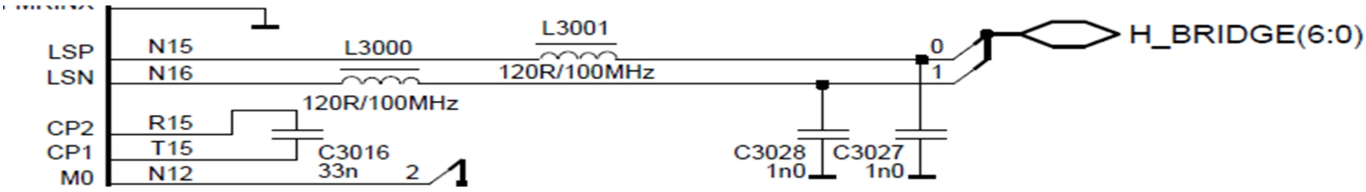

Figure 59 Speaker outputs with ferrite filters

Baseband electrical interfaces: Battery

X2080 is battery connector, battery supply voltage range is 3.2V to 4.2V. The middle pin of the connector is for battery ID, the BSI resistor value should be 68K (default value, normal mode without charging) or 3.3K (test mode), the nominal resistance of actual NTC resistor is 47K at room temperature.

Baseband electrical interfaces: Charger

Charge voltage is detected by an external voltage divider. The voltage (VCHG) is measured by a 10-bit PMU ADC with a dynamic range from 0 to 1.2V. The maximum ADC voltage corresponds to 32.4V with the current external divider ratio hence the resolution is 31.6mV/LSB.

In order to validate the charge voltage, an upper and a lower limit are programmed in the PMU charger control registers. These registers can be programmed by SW during run-time. During HW controlled precharge, the reset values are set to allow a nominal charge voltage range of 4.1 to 10.0V. Upon charger detection, the charger voltage is compared against the charge voltage limit register values, and charging is only done if the voltage is within the allowed window. When SW is running the charger detection window can be re-programmed to comply with product specifications. In Quantum the charge detection window will be set to comply with Nokia 2mm charging specification for normal and special chargers.

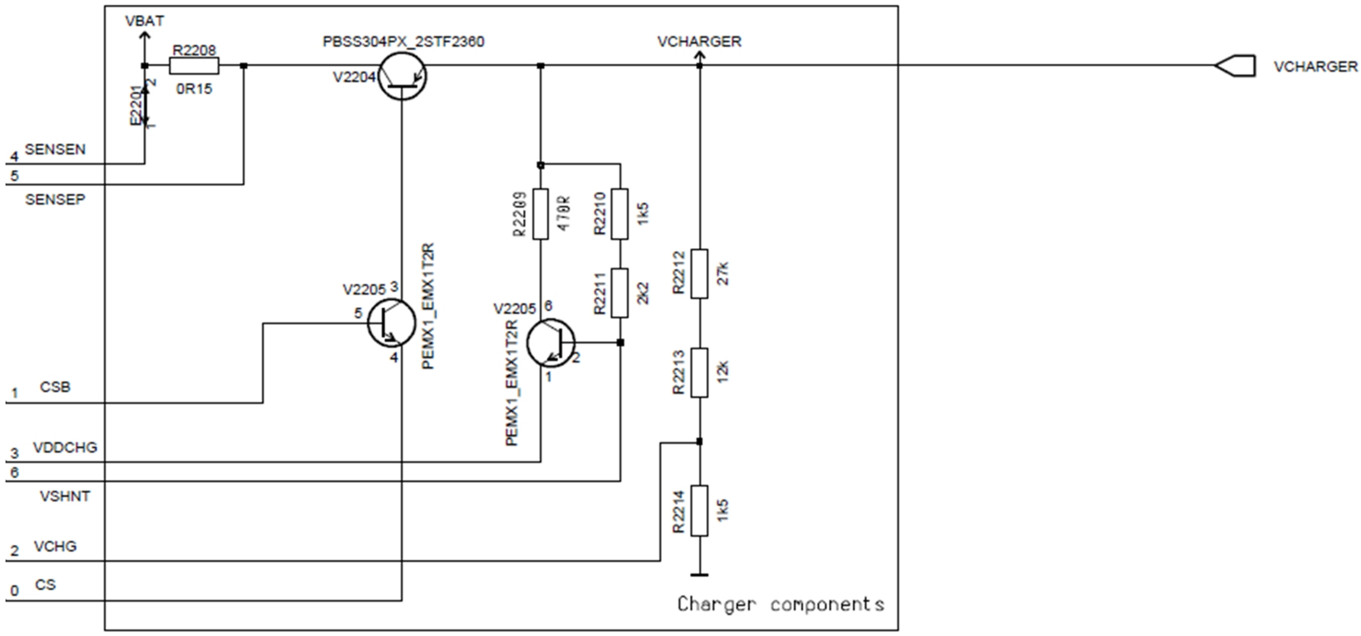

Figure 60 X-Gold213 reference charge circuit

Baseband electrical interfaces: Display(s)

The X-Gold213 DIF module provides the flexibility for the main processor to communicate with an external display of various possible type of interface.

In order to establish communication to different displays the DIF supports the low-level part of the protocol which can be configured via several registers. The low-level part covers the number of pins, their functionality and polarity. It also covers the timing parameters for the serial or parallel access of reading from or writing to the display.

The DIF module provides the following main features:

- Serial interface (supports up to 26 MHz clock rate)
- 8/9 bits high speed parallel interface with programmable timing requirements
- Multiple input formats possible: RGB up to 32 bit/pixel
- Hardware accelerator for physical protocol (pixel-bit conversion) allows to generate all common output formats for various colour depths, for example (R,G,B) =(3,3,2), (4,4,4), (5,6,5), (6,6,6), (8,8,8).
- Provision of synchronization signals to eliminate tearing effects (only in combination with the parallel display interface)

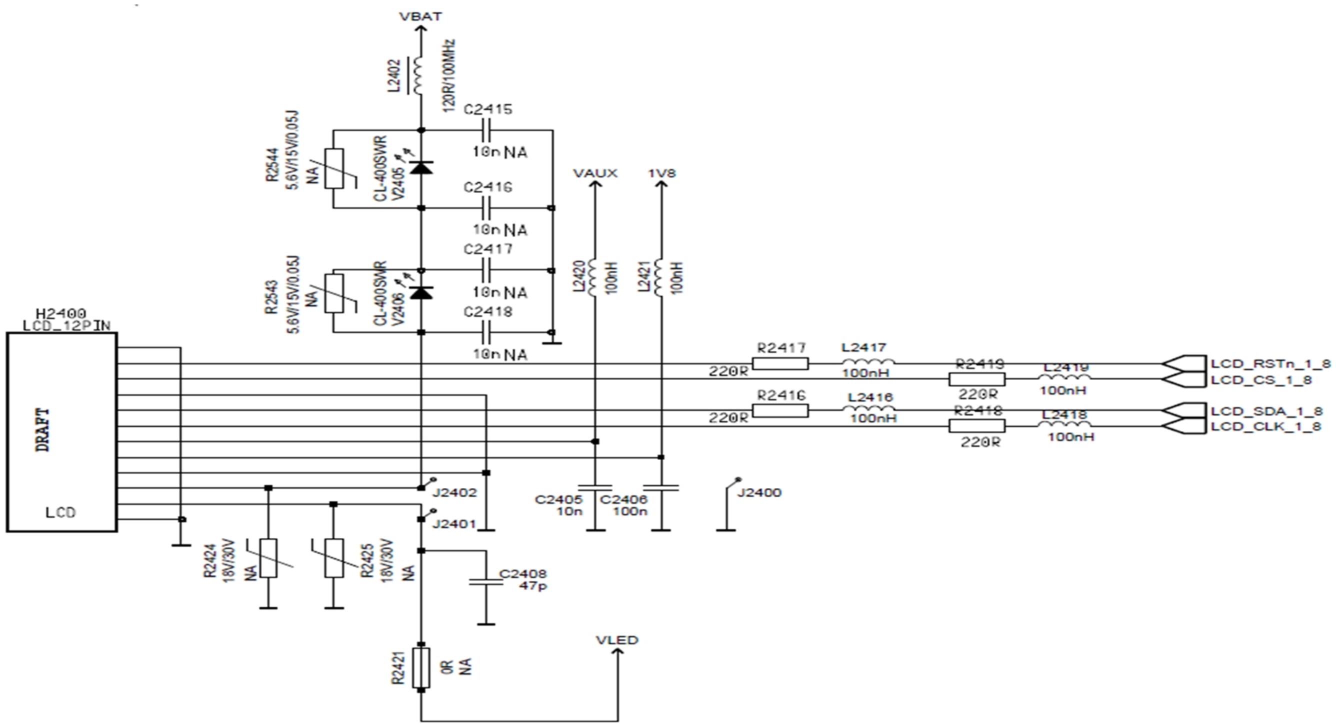

Figure 61 Serial display connection

Quantum supports both serial and parallel displays, as well as combinations of the two. The figure below shows how the display interface signals in XGOLD213 are mapped to the parallel and serial interfaces of the display(s). The Rx resistor is only needed when using dual displays, where one has serial and the other a parallel interface. The resistor will limit the maximum achievable bit rate in the receiving direction (LCD read) to app 3.25 Mb/s due to the RC filter constant created by Rx and the DIF_D1 input capacitance (Assuming Rx = 2.2 kOhm and Cin = 10 pF). In single serial display applications Rx should be shorted (MESSI_CMT0 and MESSI_CMT1 shorted).

In a dual display configuration, a GPIO must provide the chip select output for the serial connected display.

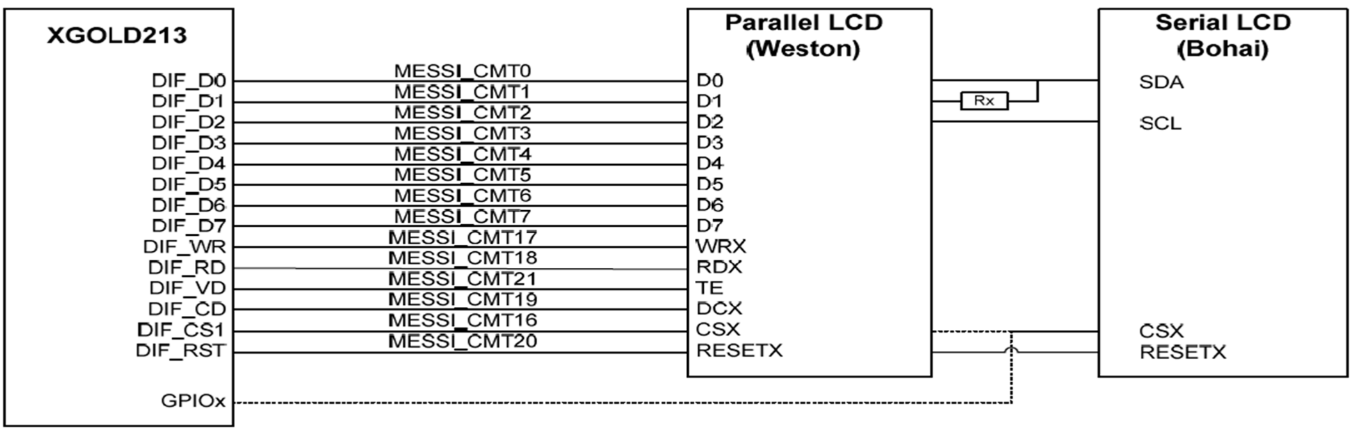

Figure 62 Display interface (parallel and serial coexist)

Baseband electrical interfaces: Memory

The memory subsystem of the Quantum supports the following features:

- Up to 512Mbit NOR flash memory
- 1.8V supply voltage for low power operation
- 16 bit bus width, A/D Muxed

- Burst mode access (up to 78MHz)
- 16KB Instruction cache
- Up to 128Mbit/256Mbit PSRA
- 1.8V supply voltage for low power operation
- 16 bit bus width, A/D Muxed
- Burst mode access (up to 78MHz)

The product utilize Nokia Combo memory ball out. 4x10 or 6x10 matrix, D3000 is address and data bus multiplex part in the design.

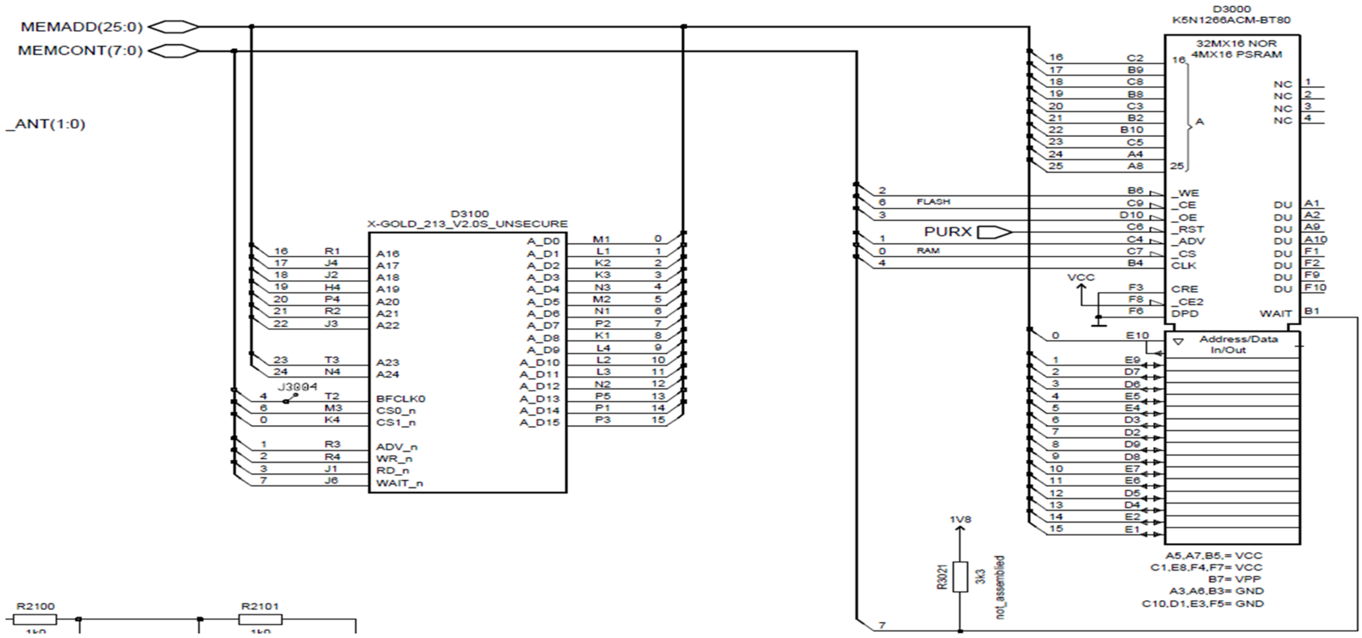

Figure 63 Memory interface connection

Baseband electrical interfaces: SIM

The Universal Subscriber Identity Module or USIM card is the logical extension of the SIM card into the 3G environment, as an evolution of the SIM card. It can be used for support of GSM Phase 2 and 3G modes.

The X-GOLD213 USIM interface is compatible with ISO 7816-3 IC card standard, required by GSM11.12 (3.0V and GSM 11.18 (1.8V) standards. It supports both 1.8V and 3.0V SIM Cards with T=0 and T=1 protocols supported by hardware. For 3V SIM cards, the nominal supply voltage is 2.85V. The SIM card is provided with a 3.25MHz clock and can be configured into low power modes. All SIM related clock signals are controlled by the SIM_CTRL register in X-Gold213.

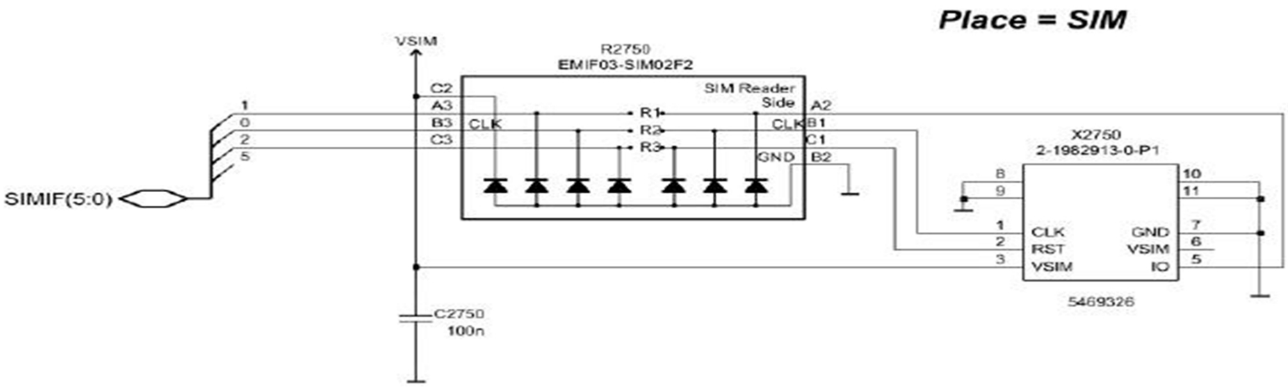

Figure 64 SIM card holder and signal protection

For ESD protection of the SIM interface signals, an integrated ESD/EMI suppression component is used. A 100nF capacitor is located very close to the SIM card connector for supply decoupling. The Design of the X-Gold213 IO's ensures that all SIM signals are actively driven low as long as a valid battery voltage is present, even in off mode, to comply with ISO7816-3 specifications.

Baseband electrical interface: Dual SIM

Dual support in Quantum is implemented using a dedicated dual SIM interface IC, LFH1001 from Infineon. The LFH1001 is a dual SIM card interface IC for use in mobile stations. It has two LDOs to provide power conversion for 1.8V and 3.0V and three level shifters per SIM card for signal level translation.

The LFH1001 interfaces between a baseband IC and two SIM cards. The LFH1001 multiplexes the signal paths of the two SIM cards so that one will be connected to the SIM interface in the baseband IC, while the other is left in clock stop mode. This allows both SIM cards to be powered and provides a flexible and efficient way of switching between the two cards without having to execute repeated de-activation and activation sequences in order to access the two cards.

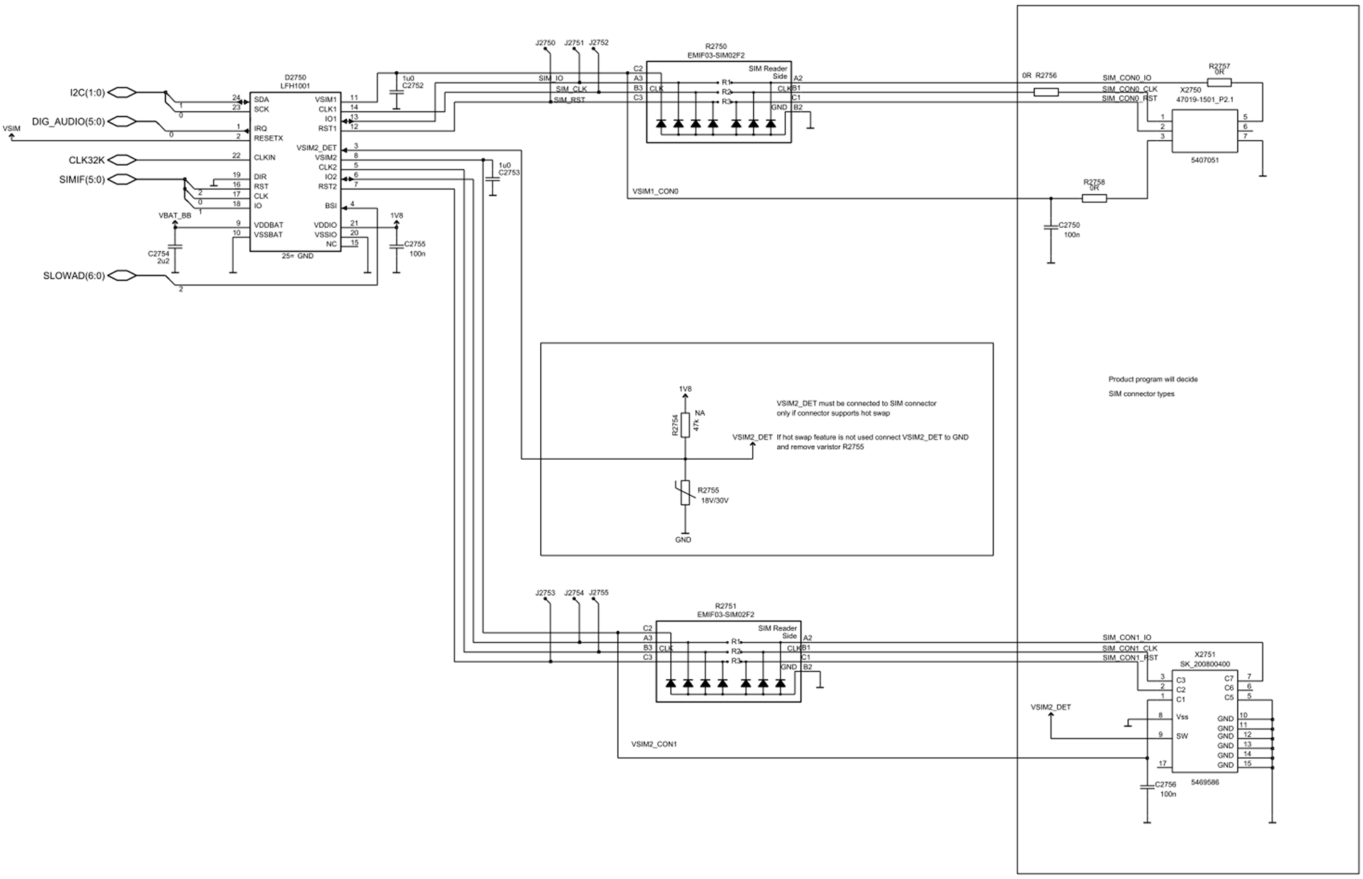

Figure 65 Dual SIM using LFH1001

The LFH1001 has an integrated detection of SIM card presence based on two application concepts:

- Battery detection in case one or both SIM cards are located behind the battery
- Contact detection in an external card reader, in case one SIM is located in a directly user accessible slot

The LFH1001 contains logic for detecting the state of the SIM cards and performing automatic shutdown of the SIM interface signals in case removal of the card is detected.

Baseband electrical interfaces: Audio components

DC blocking capacitors C2102 are inserted to center the audio input around the internal bias level. The microphone circuit is configured in pseudo-differential mode. VMIC is used for the bias. A low-pass filter comprising R2100 and C2101 is used to remove any potential noise picked-up by VMIC.

The external microphone for the headset is connected via filtering components to the second differential microphone input MICP2 and MICN2, and is designed pseudo-differentially for better noise immunity. DC blocking capacitors C2107 are used. VUMIC for the biasing. A low-pass filter comprising R2105 and C2105 removes any potential noise picked-up by VUMIC.

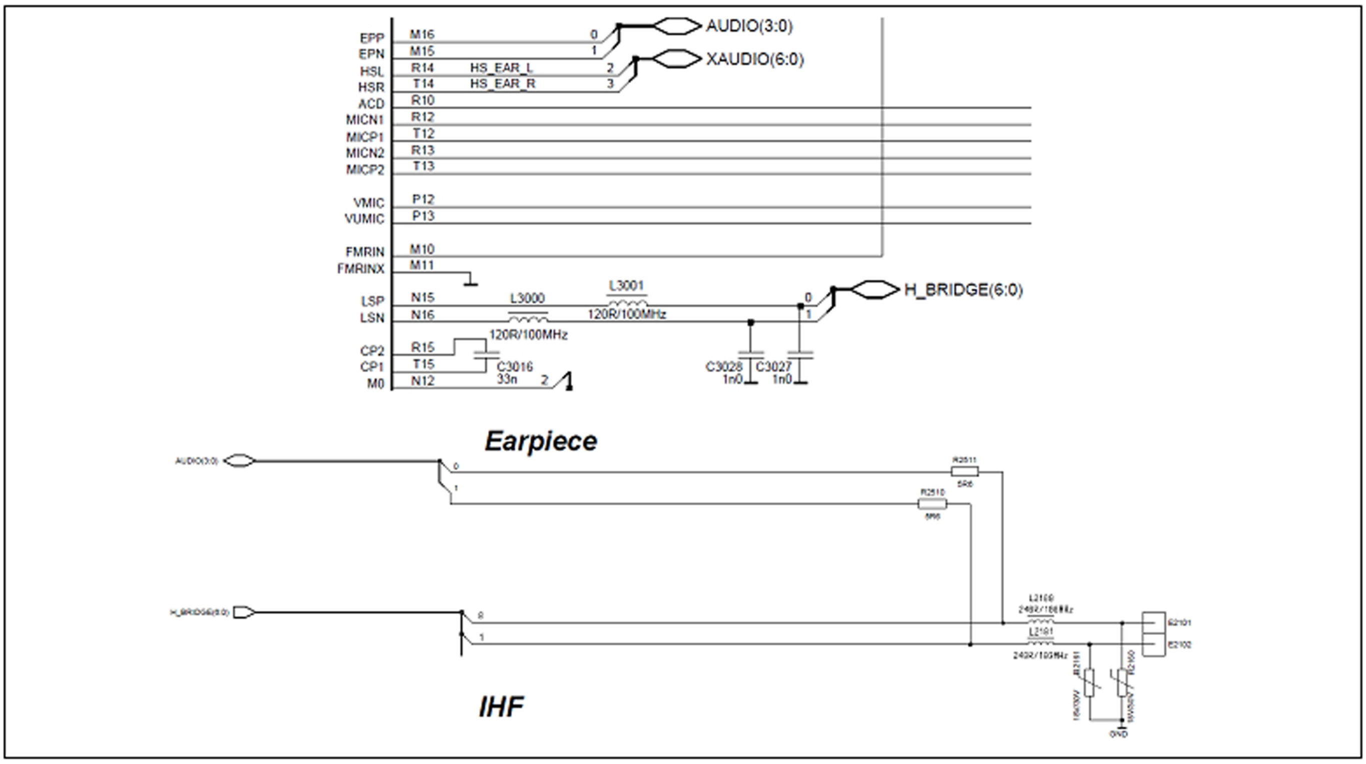

Figure 66 Earpiece and loudspeaker components

R2511 and R2510 are matching resistor to adapt to high impedance of IHF.

Baseband electrical interfaces: Backlight and illumination

The backlight supply is implemented using the integrated boost converter control circuit of X-Gold213.

The converter circuit is running in the analog feedback control mode, where the on time of the NMOS switch V7009 is controlled by a comparator triggered by the inductor peak current, while the off time is controlled by a counter, which resets the NMOS switch when it reaches a pre-programmed value.

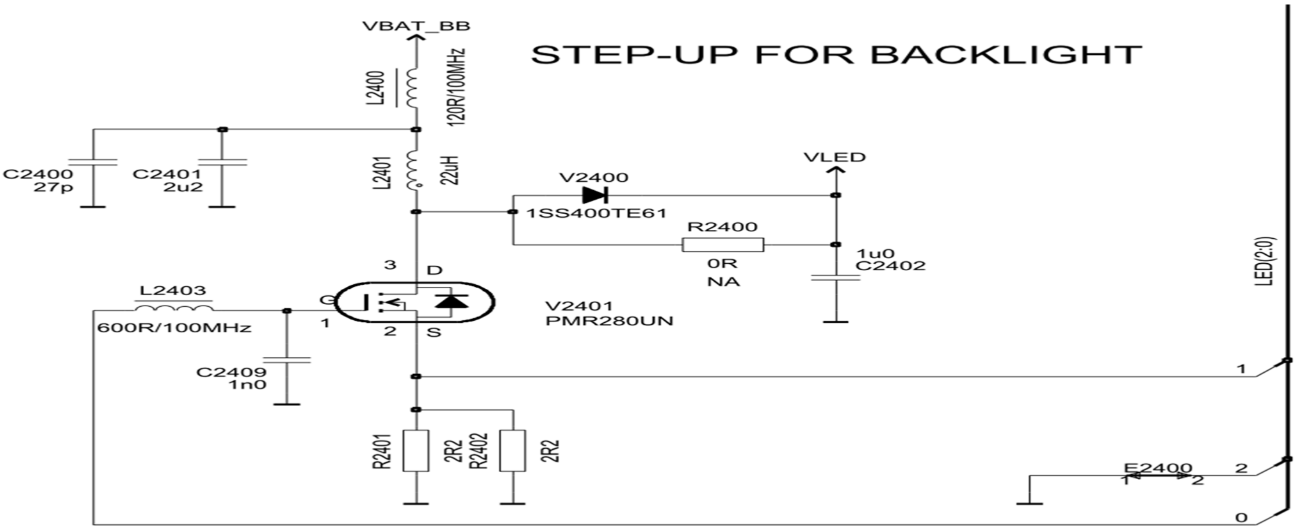

Figure 67 Step-up backlight driver

Baseband electrical interfaces: Keyboard

The key interface supports a 5 x 5 matrix. There are two different modes of operation: standby mode and active scanning mode.

In standby mode all scan output rows KEYOUT[0:#] are set to low. The scan input columns lines KEYIN[0:#] are pulled high by internal pull-up resistors. In case of a key press, the corresponding KEYIN will be pulled low. The logic states of all the input lines are AND'ed internally in the GOLD213 to generate an interrupt request to wake up the CPU if any key is activated during standby. In case of interrupt, the CPU will read the corresponding row and initiate an active key scan to identify the correct column. The key interface will also allow detection of two simultaneously pressed keys.

The PWRON key is for power on function, it is pull up by VRTC.

Baseband electrical interfaces: Camera

The X-Gold213 CIF is a high performance camera interface block that implements the complete video and still picture input interface solution for mobile phone applications. It supports a maximum input frame resolutions of up to 3MPixels (2048x1536 pixels).

Since X-Gold213 does not support a serial camera interface, an interface, or de-serializer, IC is used. This IC converts the CCP-2 compatible serial camera data to an 8-bit parallel format compatible with the XGold213 camera interface.

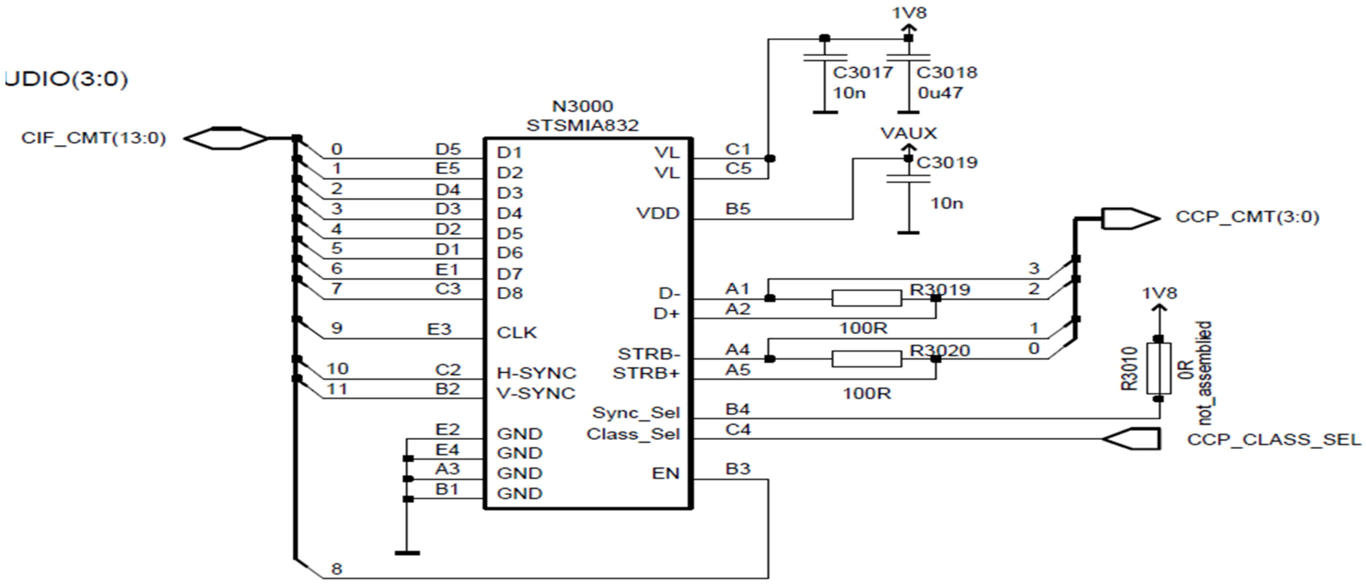

Figure 68 Camera de-serializer for serial camera module

Baseband electrical interfaces: Memory card

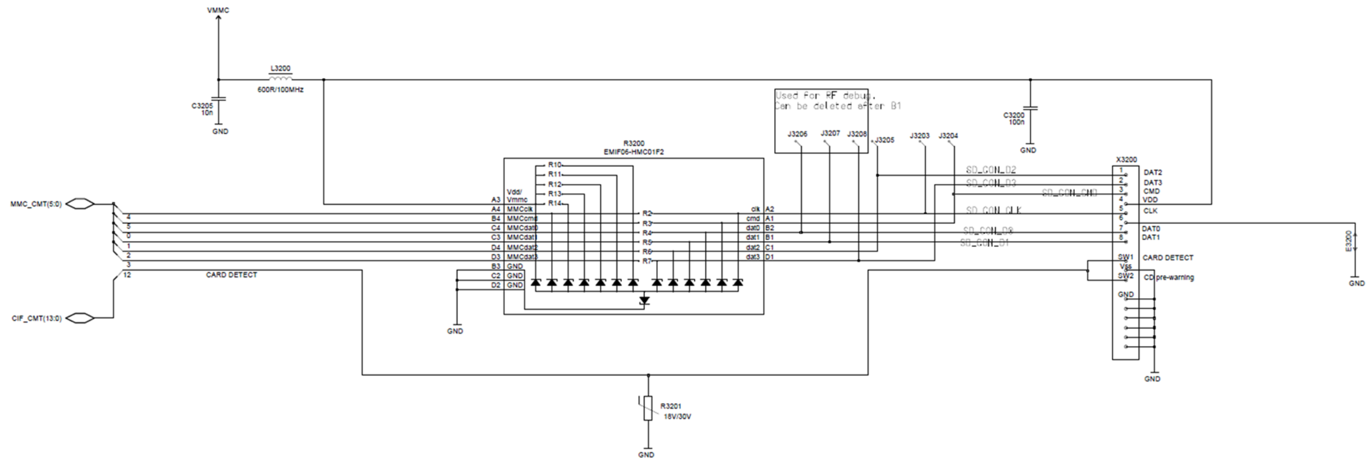

Figure 69 SD-card interface

The XGold213 MMCI interface is connected to the SD-card connector through an ASIP R3200 providing EMI filtering and ESD protection. A build in switch in the connector X3200 provides a logic signal for detection of card insertion and removal.

Baseband electrical interfaces: Vibrator

The vibrator function is supported using the VIB driver in the X-GOLD213. This driver features a VBAT supplied push-pull output stage which is intended for driving a vibrator motor. The engine also supports vibrating using the 3-in-1 multi-actuator device.

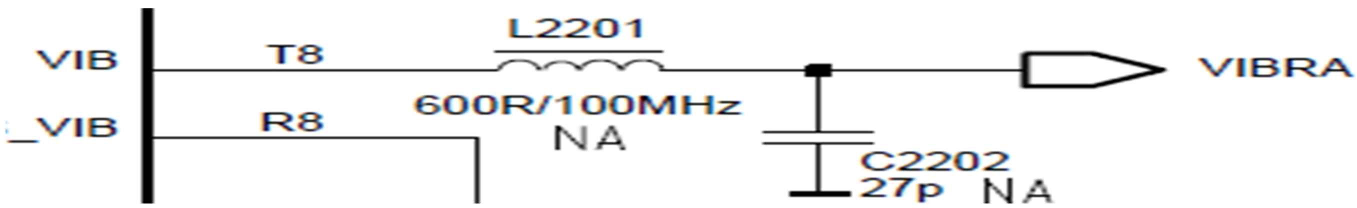

Figure 70 Vibrator circuits

Baseband electrical interfaces: BT module

The BTRDS device is interfaced to the Quantum engine. An asynchronous serial interface with HW flow control implemented on the XGold213 USIF1 HW block provides the control/data interface, with optional digital audio data interface provided with an I2S interface. The interface furthermore supports a bidirectional wake up mechanism through dedicated signals UART_WAKE and BT_WAKEUP in. The Quantum engine also provides a 32 kHz sleep clock output and a 26MHz main clock to the BTRDS device. Activation of the 26MHz can be requested by the BTRDS device by asserting the BT_CLK_REQ signal.

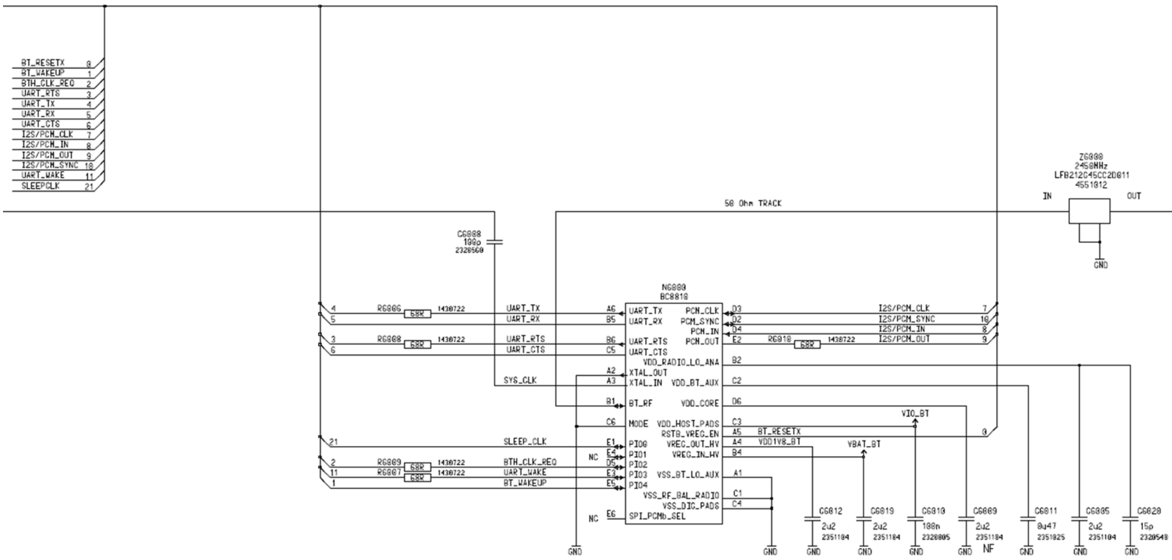

Figure 71 BT circuits

RF System Module

Overview

This Chapter contains a brief introduction to the design of the RF part for the Quantum engine block in order to give the maintenance operator a good knowledge of the RF HW for making debugging and troubleshooting easier.

The assumption is that the service centre is equipped according to the Nokia's Level 3 as described in "Recommended service equipment, for authorized Nokia service suppliers" Version 30, 01 Nov. 2009 by Nokia.

RF general description

The RF part of the Quantum engine is a 2G block using the Infineon X-GOLD213 IC RF sub-system as the RF transceiver module, which supports dual-band GSM voice and data applications (GPRS class 10 with the feature of RX EGPRS capability). It also supports 2 different Front End Modules, FEM, (Renesas EU and Skyworks EU) includes both dual-band power amplifiers and antenna switch for RX/TX path switching functionalities. The 26MHz reference clock is generated by a build-in digitally adjustable oscillator with one off-chip crystal. Furthermore the engine supports FM radio functionality with an on-chip FM radio block. The external circuitry needed for the FM radio is the LNA and the antenna. BT is also supported with an external BT chipset.

Frequency plan

Quantum is a dual band engine, which supports either EU version or US version frequency bands. The frequency plan and power class are shown in the following table.

Table 4 Quantum Frequency Plan

Version	Band	Frequency Plan	GMSK Power Class
EU	GSM900	TX: 880-915MHz	4 (Max PCL5 = 33dBm)
		RX: 925-960MHz	
	GSM1800	TX: 1710-1785MHz	1 (Max PCL0 = 30dBm)
		RX: 1805-1880MHz	

Regulators and power supply concept

In the X-GOLD213 IC, VRF1 and VDD1V8 are the regulated output voltages of the DCDC step down converter and supply the RF, the digital core, and the analogue part. The remaining regulators are supplied by the battery directly for increasing the efficiency.

The following figure shows the power concept of the X-GOLD213 IC RF sub-system.

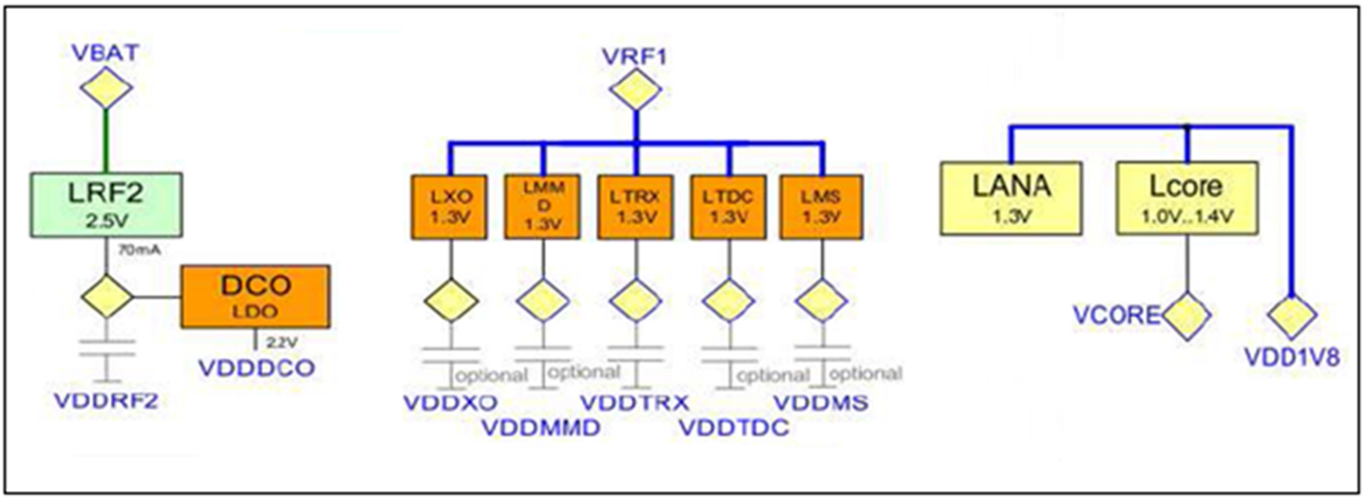

Figure 72 Power concepts for X-GOLD213 RF sub-system

In the following table, the RF power supply names, IC ball numbers, description for use, and at which components the supply voltage can be measured at are listed.

Table 5 Power supply voltages for the X-GOLD213 IC RF sub-system

Name	Ball No.	Test point	Function
VBAT	G14	C7134	3.6V typ. Battery voltage, supply voltage of D2B LDO
VDDRF2	G13	C7106	2.5V D2B output voltage, part of RF supply
VRF1	H10	C7121	1.8V DCDC output voltage, supply of 1.3V LDOs
VDDTRX	B14	C7124	1.4V Transceiver supply
VDDTDC	B12	C7131	1.3V VDD for Time to Digital Converter of DPLL
VDDMS	H13	C7123	1.3V Mixed signal supply
VDDXO	E11	C7130	1.3V DCXO supply
VDDMMD	A12	NONE	1.3V VDD for Multi Modulus Divider of DPLL

RF block diagram

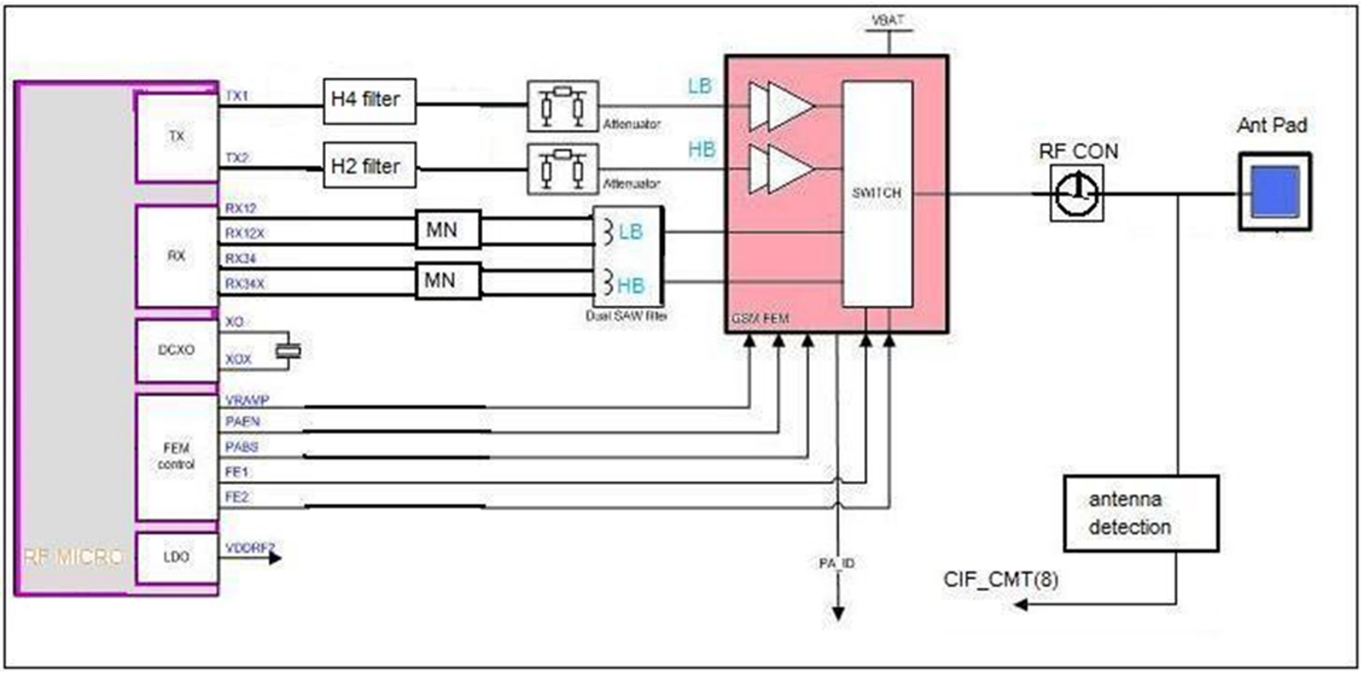

Figure 73 RF block diagram

TX path overview

The TX digital architecture in the X-GOLD213 IC is based on a fractional-N sigma-delta synthesizer to generate the two outputs at the TX1 port and TX2 port; LB and HB respectively. At The TX outputs, the AC coupled Capacitors are removing the DC from the X-GOLD213 IC, the RF signal is then harmonic filtered by a H4 filter (4th Harmonic Notch Filter) for LB and a H2 filter (2nd Harmonic Notch filter) for HB (both filter are series resonance filter to GND), and attenuated by a 2dB attenuator before the FEM (PA+ antenna switch). The input signal to the FEM is a GMSK RF modulated carrier signal in the range of -3dBm to +3dBm. The PA amplifies the signal to its wanted output power level (PCL of the GSM specification) determined by the amplitude level of the Vramp signal. The RF output signal from the FEM is delivered to the RF connector (RF production/debug connector) if a RF cable is present or to the Antenna Pad in case of no RF cable connected. A detailed description of the TX path in the RF part of the Quantum engine can be found in Appendix B.

RX path overview

The RX signal is input from the Antenna or from the RF connector if the RF cable is attached to the production RF connector. The RF signal is then input to the antenna switch of the FEM, where it is switched to either the LB path or the HB path. This is controlled by the settings of FE1/VC1 (TX-RX Switch), PABS/VC2 (Band Select), and FE2/VC3 (Antenna Switch configuration); see the FEM logic table in Table 7. The antenna input signal is then band-pass filtered in the SAW filter module with the RX in-band frequencies as specified in Table 1. After BP filtering the RF signal is matched to the impedance of the X-GOLD213 IC differential inputs for optimum receiver sensitivity performance. In the X-GOLD213 IC the RX input signals are amplified by a Low Noise Amplifier (LNA) and down converted to Low IF and again amplified before demodulated and signal processed. A detailed description of the RX path in the RF part of the Quantum engine can be found in Appendix A.

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X-TAL/DCXO

The X-Tal and DCXO is the 26MHz Reference Clock used by the entire platform as an accurate clock. The clock frequency can be controlled and adjusted by the embedded capacitor bank of the DCXO (Integrated in the X-GOLD213). During synchronization to base-station or base-station emulator (Normal mode/signalling mode) the accuracy of the clock should be max 0.1ppm, however in normal mode the accuracy can be ±60ppm depending on the setting of the AFC DAC value.

Antenna detection

The antenna detection circuit is applied to determine if the antenna is mechanically mounted or not. The antenna circuitry consist by a current sourced ADC from the X-Gold, that's are sourcing the resistors R7454 and R7460 to the antenna pad E7454. The antenna has an 0 impedance @ DC to GND if mounted correctly. The ADC (embedded in the X-GOLD213) measured the voltage and use this to evaluate if the antenna is mounted or not, and if the antenna connection to the pad E7454/E7453 is okay or not. The detailed circuit is shown in the figure below.

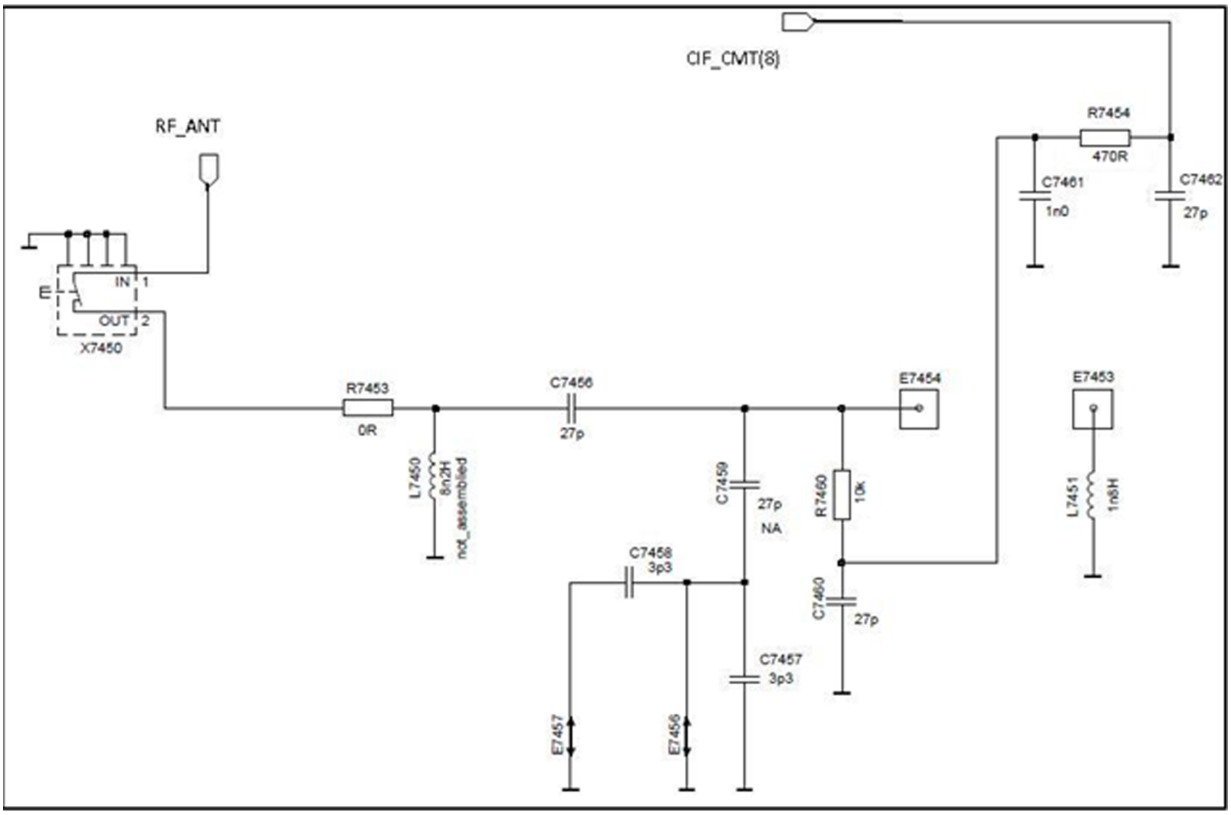

Figure 74 Antenna detection circuit

FEM ID/PA ID

The FEM ID (PA ID) is used for FEM identification depending on the different release, see Table 2 . For more info regarding the FEM ID see Appendix E.

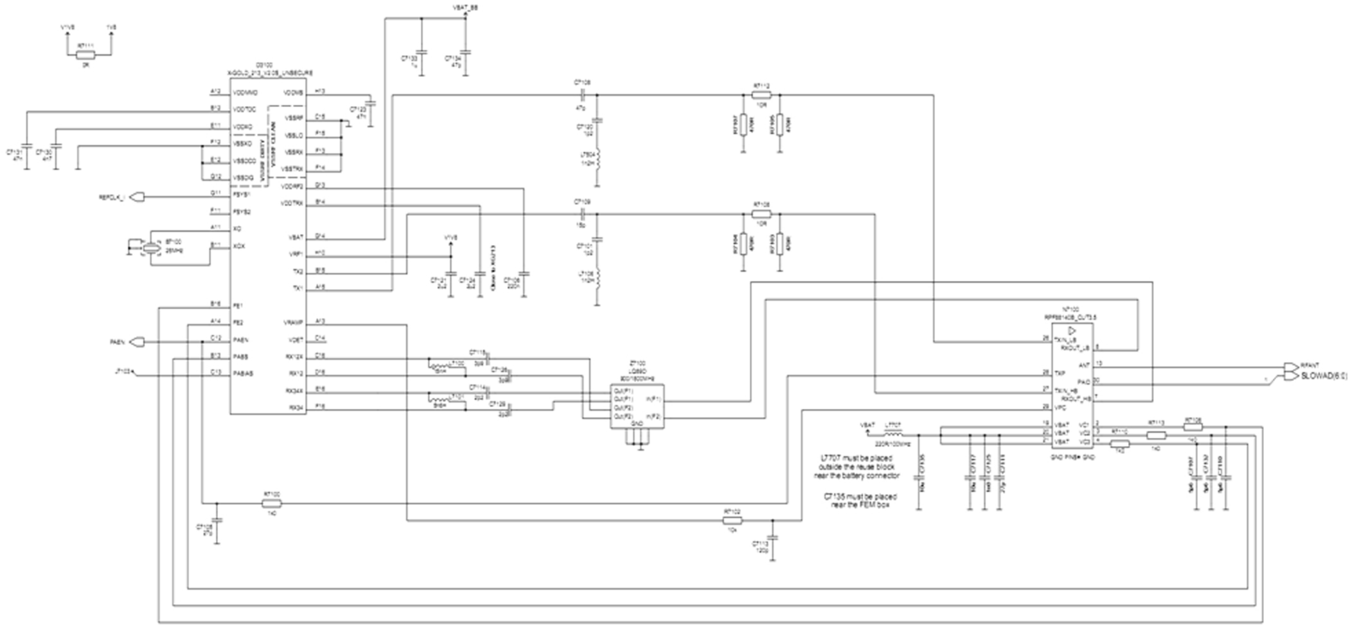

Figure 75 Quantum B2 RF schematic (For Release 3, see Table 2 for components values of the other releases)

BOM release version and RF part list

Quantum has four release versions in terms of the FEM suppliers and EU/US variation. Rel.1 and Rel.3 are for EU (GSM900/1800) version and Rel.2 and Rel.4 are for US (GSM850/1900) version. The FEM, SAW filters, and RX matching networks are different for each release as shown in the table below. The PA ID resistor embedded in the FEM, makes it possible for the X-GOLD to determine which release is used.

Table 6 Schematic differences between releases

	Rel.1	Rel.3
BAND	EU	EU
C7114	2p2(2320520)	2p2(2320520)
C7129	2p2(2320520)	2p2(2320520)
C7115	3p9(2320526)	3p9(2320526)
C7126	3p9(2320526)	3p9(2320526)
L7100	15nH(3640122)	18nH(3640171)
L7101	5n6H(3646059)	5n6H(3646059)
N7100	Sky 77535 (4355168)	RPF88140B (4355148)
Z7100	Epcos(4511256)	Murata(4511258)

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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FM	Frequency Modulation
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity

IR	Infrared
IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MP3	Compressed audio file format developed by Moving Picture Experts Group
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PCM	Pulse Code Modulation
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board

PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RDS	Radio Data Service
RF	Radio Frequency
RF PopPort ™	Reduced function PopPort ™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC

USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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